TM 8-6530-009-24&P

TECHNICAL MANUAL

UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)

VENTILATOR, VOLUME, PORTABLE MODELS 750 AND 750M

6530-01-327-0686

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

HEADQUARTERS, DEPARTMENT OF THE ARMY

1992

SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL.

IF POSSIBLE, TURN OFF THE ELECTRICAL POWER.

IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE, OR SOME OTHER INSULATING MATERIAL.

SEND FOR HELP AS SOON AS POSSIBLE.

AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION.

Throughout this manual are WARNINGS, CAUTIONS, and NOTES. Please take time to read these. They are there to protect you and the equipment.

WARNING

Procedures which must be observed to avoid personal injury, and even loss of life.

CAUTION

Procedures which must be observed to avoid damage to equipment, destruction of equipment, or long-term health hazards.

NOTE

Essential information that should be remembered.

OXYGEN AND OXIDIZING GAS HAZARDS

» Oxygen and gas mixtures containing large quantities of oxygen react chemically with organic materials to produce heat. This reaction can take place with explosive violence.

» Electrostatic discharge and other potential sources of ignition should be kept away from high concentrations of oxygen or oxygen enriched gas mixtures.

» Never permit oil, grease, or other combustible substances to come in contact with cylinders, valves, regulators, hoses, and fittings used for oxidizing gases such as oxygen.

» Oxygen and gas mixtures containing oxygen pose the potential for oxidation of steel cylinders. The oxidation will reduce the strength of the cylinders. Such cylinders must be periodically inspected and tested.

» Human exposure to atmospheres containing 12 percent or less oxygen will result in unconsciousness without warning, and so quickly that you cannot help or protect yourself.

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DEPARTMENT OF THE ARMY
WASHINGTON, DC

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VENTILATOR, VOLUME, PORTABLE
MODELS 750 AND 750M

6530-01-327-0686

You can help improve this manual. If you find any mistakes or if you know a way to improve procedures, please let us know. Mail your memorandum, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 (Recommended Changes to Equipment Technical Publications) located in the back of this manual, to: Commander, U.S. Army Medical Materiel Agency, ATTN: SGMMA-M, Frederick, MD 21702-5001. A reply will be furnished directly to you.

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HOW TO USE THIS MANUAL

☐ This manual provides all the information needed to understand the capabilities, functions, and characteristics of this equipment. It describes how to set up, operate, test, and repair the equipment. You must familiarize yourself with the entire manual before operating or beginning a maintenance task.

☐ The manual is arranged by chapters, sections, and paragraphs followed by appendixes, a glossary, an index, and DA Forms 2028-2. Use the table of contents to help locate the chapter or section for the general subject area needed. The index will help locate more specific subjects.

☐ Multiple figures and tables are provided for your ease in using this manual. Words or terms that you will actually see on the equipment are represented in the text as closely as possible. Terms, symbols, and numbers that you will actually see in the control module displays will be in quotation marks.

☐ Chapter 4 provides a systematic method of inspecting and servicing the equipment. In this way, small defects can be detected early before they become a major problem causing the equipment to fail. Make a habit of doing the checks and services in the same order each time and anything wrong will be detected quickly.

☐ Specific direct support and general support maintenance instructions are included. Only perform maintenance functions specified in the maintenance allocation chart for your level of maintenance. Maintenance functions specified for higher levels of maintenance frequently require additional training; test, measurement, and diagnostic equipment; or tools.

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. Scope.

This manual describes the ventilator (fig 1-1); provides equipment technical data; and provides operational and maintenance functions, services, and actions. Additional information follows:

a. Type of manual. Unit, direct support (DS), and general support (GS) maintenance (including repair parts and special tools list).

b. Model numbers and equipment name. Model numbers 750 and 750M, Ventilator, Volume, Portable.

c. Purpose of equipment. To provide ventilation or respiratory assistance to patients who cannot breathe normally because of illness, trauma, congenital defects, or drugs (e.g., anesthetics).

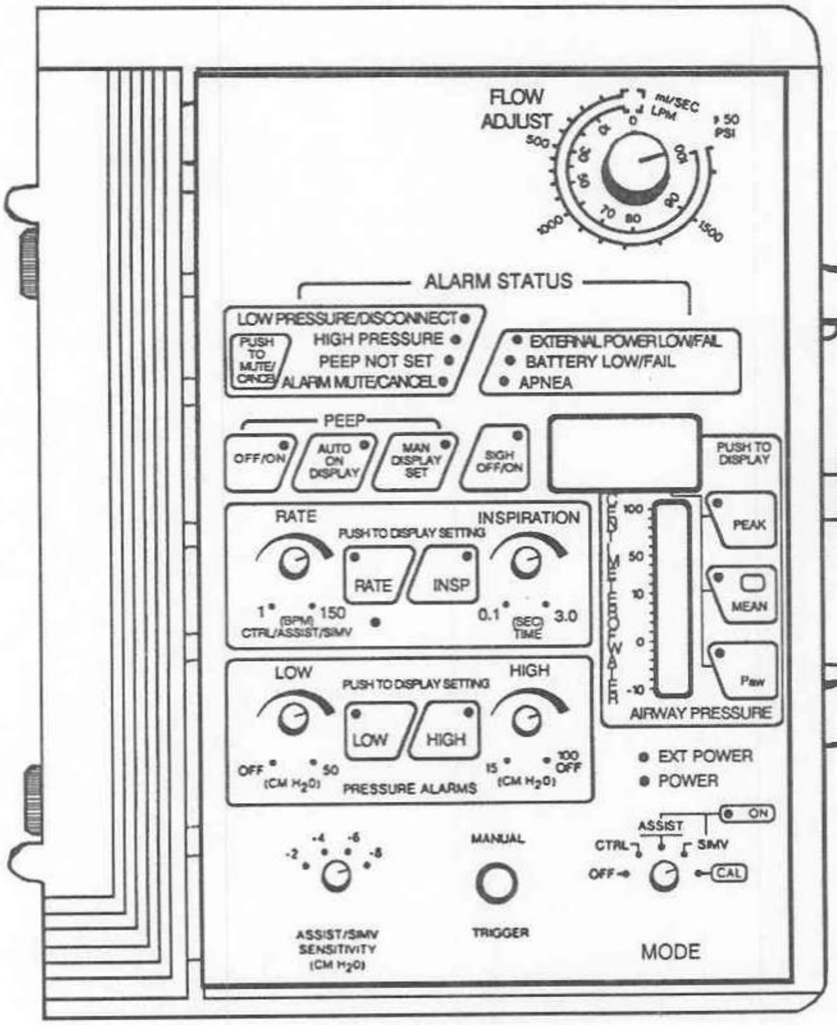

FLOW
ADJUST
ml/SEC
LPM
50 PSI
0
10
30
50
70
80
90
100
500
1000
1500
ALARM STATUS
LOW PRESSURE/DISCONNECT
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
PUSH TO MUTE/CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
OFF/ON
AUTO ON DISPLAY
MAN DISPLAY SET
SIGH OFF/ON
PUSH TO DISPLAY
PEAK
MEAN
Paw
CENTIMETERS OF WATER
100
50
10
0
-10
AIRWAY PRESSURE
RATE
INSPIRATION
PUSH TO DISPLAY SETTING
RATE
INSP
1
150
(BPM)
CTRL/ASSIST/SIMV
0.1
3.0
(SEC) TIME
LOW
HIGH
PUSH TO DISPLAY SETTING
LOW
HIGH
OFF
50
(CM H2O)
PRESSURE ALARMS
15
100 OFF
(CM H2O)
EXT POWER
POWER
ON
ASSIST
CTRL
SIMV
OFF
CAL
MODE
-2
-4
-6
-8
ASSIST/SIMV SENSITIVITY (CM H2O)
MANUAL
TRIGGER

Figure 1-1. Ventilator, volume, portable.

1-2. Explanation of abbreviations and terms.

Special or unique abbreviations, acronyms, and terms used within this manual are explained in the glossary.

1-3. Maintenance forms, records, and reports.

TB 38-750-2 prescribes forms, records, reports, and procedures.

1-4. Destruction of Army materiel to prevent enemy use.

AR 40-61 contains instructions for destruction and disposal of Army medical materiel. Also, the SB 8-75 series provides periodic information and/or instructions on the destruction of medical materiel.

1-5. Administrative storage.

a. Place the ventilator in administrative storage for only short periods of time when a shortage of maintenance effort exists. This equipment should be in mission readiness condition within 24 hours or within the time factors determined by the directing authority. During the storage period, keep appropriate maintenance records.

b. Perform preventive maintenance checks and services (PMCS) listed in table 4-1 before placing Army equipment in administrative storage. When equipment is removed from storage, perform PMCS to ensure its operational readiness.

c. Inside storage is preferred for equipment selected for administrative storage.

1-6. Preparation for storage or shipment.

Procedures to prepare the ventilator for storage or shipment are listed in chapter 4, section XI.

1-7. Quality assurance or quality control (QA or QC).

TB 740-10/DLAM 4155.5/AFR 67-43 contains QA or QC requirements and procedures.

1-8. Nomenclature cross-reference list.

Table 1-1 identifies official versus commonly used nomenclatures.

Table 1-1. Nomenclature cross-reference list.

Common name	Official nomenclature
Assist mode	Assist-control mode
Blender	Blender/mixer or air/oxygen blender
Connector	Header
Transducer	Pressure transducer
Ventilator	Ventilator, volume, portable

1-9. Reporting and processing medical materiel complaints and/or quality improvement reports.

AR 40-61 prescribes procedures for submitting medical materiel complaints and/or quality improvement reports for the ventilator.

1-10. Warranty information.

A warranty is not applicable.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-11. Equipment characteristics, capabilities, and features.

a. The ventilator is portable, electronically controlled, time-cycled, and pressure limited. It is controlled by a microprocessor which continuously monitors a patient's airway pressure, all control settings, alarm parameters, and electrical power signals. The device provides ventilatory support in multiple modes.

b. The ventilator operates either from internal rechargeable 12-volt batteries or from external electrical power as specified in table 1-3.

c. The microprocessor monitoring circuit is connected to a complex alarm system. Alarms include—

(1) internal and external power,
(2) low airway pressure,
(3) patient disconnection,
(4) high airway pressure, and
(5) positive end expiratory pressure (PEEP).

d. The ventilator is extremely durable and designed to operate in all environments.

e. The control module case is made of flame-retardant, acrylic-reinforced, polyvinylchloride (PVC).

f. The ventilator delivers gas from various sources to include—

(1) oxygen or air cylinders,
(2) piped oxygen or air,
(3) compressors that are filtered and free of oil, and
(4) onboard aircraft generators.

1-12. Component descriptions.

a. Control module (fig 1-2). The control module incorporates a handle, a cover for the control panel, a cover for the battery pack assembly, and other assemblies which contain the various controls, indicators, displays, and connectors. The MODE selector switch is also the power switch to start or stop ventilator operation.

b. Patient valve (fig 1-3). This valve provides the interconnection between the control module and a patient.

c. Power supply (fig 1-4). The multivoltage power supply provides for operation of the ventilator on multiple alternating current (AC) and direct current (DC) power sources. It also serves as a source of electrical power for recharging the ventilator's internal batteries.

d. Case (fig 1-5). The case, with polyurethane cushioning material, provides protection for the ventilator during transit and it also provides for storage of ventilator components and accessories. The polyurethane material has cutouts to position the ventilator components.

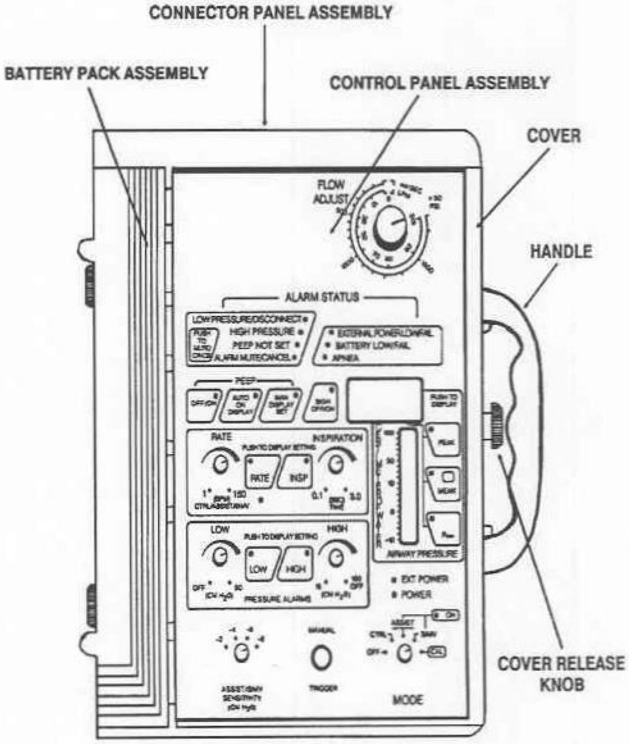

CONNECTOR PANEL ASSEMBLY
BATTERY PACK ASSEMBLY
CONTROL PANEL ASSEMBLY
COVER
HANDLE
COVER RELEASE KNOB
FLOW ADJUST
ALARM STATUS
LOW PRESSURE/DISCONNECT
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
PUSH TO AUTO CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
OFF/ON
AUTO ON DISPLAY
PUSH TO DISPLAY
RATE
INSPIRATION
PUSH TO DISPLAY SETTING
RATE
INSP
1
150
BPM
CTRL/ASSIST/SIMV
0.1
3.0
INSP TIME
LOW
HIGH
PUSH TO DISPLAY SETTING
LOW
HIGH
OFF
PRESSURE ALARMS
AIRWAY PRESSURE
EXT POWER
POWER
MANUAL
TRIGGER
ASSIST/SIMV SENSITIVITY
MODE
CTRL
ASSIST
SIMV
OFF

Figure 1-2. Control module.

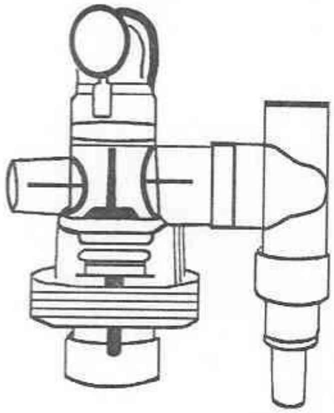


Figure 1-3. Patient valve.

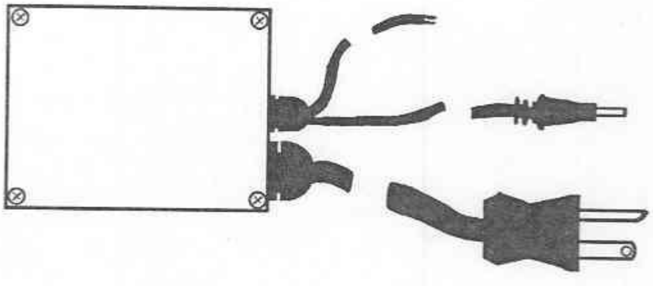


Figure 1-4. Power supply.

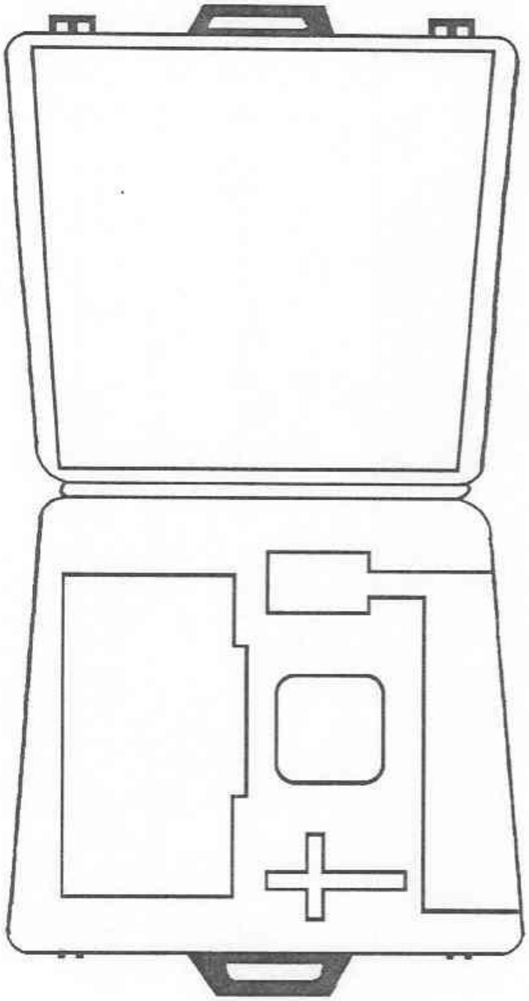


Figure 1-5. Case.

1-13. Tabulated data, decals, and data plates.

The tabulated data provides the specifications, physical characteristics, and other information for the ventilator.

a. Specifications and physical characteristics. Tables 1-2 and 1-3 provide a broad range of specifications and physical characteristics to include operating voltages, battery operating time, operating/storing temperature ranges, dimensions, and weights.

Table 1-2. Specifications.

Input gas pressure range	50 to 100 psi
Input pressure calibration point	50 psi
Flow rate	0 to 100 lpm (1600 mL/sec) at 50 psi
Ventilation rate	1 to 150 breaths/min
Inspiration time range	0.1 to 3.0 sec
Low pressure alarm activation range	0 to 50 cm H_2O
High pressure alarm activation range	15 to 100 cm H_2O
Peak inspiratory pressure relief range	15 to 100 cm H_2O
ASSIST/SIMV sensitivity range	-2 to -8 cm H_2O
PEEP range	1 to 20 cm H_2O
Digital graph range	-10 to 100 cm H_2O

Table 1-3. Physical characteristics.

Operating voltages	
Control module	12 VDC (negative ground)
Multivoltage power supply	115 VAC, 50/400 Hz or 230 VAC, 50/400 Hz or 11/30 VAC/VDC or 12 VDC
Operating time	
Internal batteries (continuous)	9 hrs
External AC	Continuous
External DC	Continuous
Temperature ranges	
Operating	-60°C (-76°F) to 60°C (140°F)
Charging	-20°C (-4°F) to 50°C (122°F)
Long-term storage	10°C (50°F) to 30°C (86°F)
Case dimensions (nominal)	
Width	58.42 cm (23.0 in)
Height	18.42 cm (7.25 in)
Depth	40.64 cm (16.0 in)
Control module dimensions (nominal)	
Width	23.88 cm (9.4 in)
Height	29.21 cm (11.5 in)
Depth	11.43 cm (4.5 in)
Weight	
Control module	4.54 kg (10.0 lbs)
Multivoltage power supply	1.14 kg (2.5 lbs)
Case	3.53 kg (8.0 lbs)

b. Identification, instruction, or markings.

(1) A manufacturer data plate, located on the back of the ventilator control module, is depicted in either figure 1-6 (model 750) or figure 1-7 (model 750M).

(2) The multivoltage power supply data plate, located on the top, is depicted in figure 1-8.

(3) A decal providing condensed operating instructions and a tidal volume computation chart, located on the back of the ventilator, is depicted in figure 1-9.

(4) Lettering on the connector panel of the ventilator is depicted in figure 1-10.

MODEL NUMBER: 750

11-30 VDC/VAC, 115-230 VAC 1.5 AMPS 50/400 HZ

SER. NO. XXXXXXX

IMPACT Instrumentation, Inc.
27 Fairfield Place, West Caldwell, NJ 07006

Figure 1-6. Data plate (model 750).

SER. NO. XXXXXXX
CONTRACT: DLA120-90-C-8565

IMPACT INSTRUMENTATION, INC.
VENTILATOR, VOLUME, PORTABLE, MODEL 750M
12 VDC 1.5A, 18W
DES. ACT. 89875 FSCM 63346
PART NO. DPSC-DEPMEDS-AT

NSN: 6530-01-327-0686 MFD 4Q90
US

Figure 1-7. Data plate (model 750M).

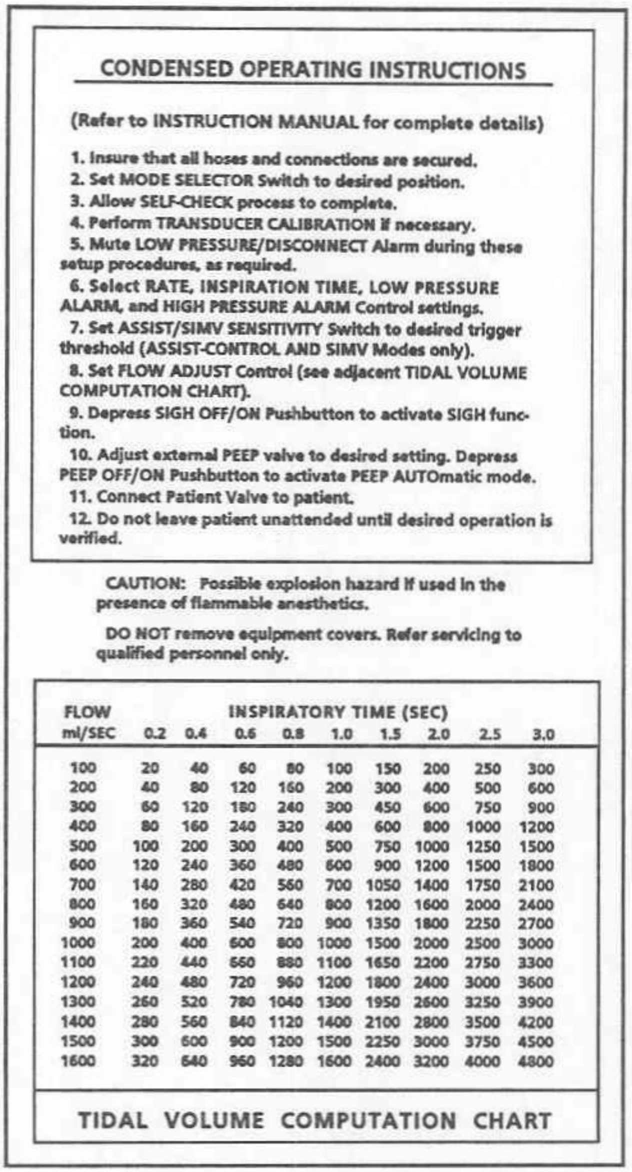
MODEL NUMBER: 750

12 DC VOLTS 1.5 AMPS

SER. NO. XXXXXXX

IMPACT Instrumentation, Inc.
27 Fairfield Place, West Caldwell, NJ 07006

Figure 1-8. Data plate (multivoltage power supply).



CONDENSED OPERATING INSTRUCTIONS

(Refer to INSTRUCTION MANUAL for complete details)

1. Insure that all hoses and connections are secured.
2. Set MODE SELECTOR Switch to desired position.
3. Allow SELF-CHECK process to complete.
4. Perform TRANSDUCER CALIBRATION if necessary.
5. Mute LOW PRESSURE/DISCONNECT Alarm during these setup procedures, as required.
6. Select RATE, INSPIRATION TIME, LOW PRESSURE ALARM, and HIGH PRESSURE ALARM Control settings.
7. Set ASSIST/SIMV SENSITIVITY Switch to desired trigger threshold (ASSIST-CONTROL AND SIMV Modes only).
8. Set FLOW ADJUST Control (see adjacent TIDAL VOLUME COMPUTATION CHART).
9. Depress SIGH OFF/ON Pushbutton to activate SIGH function.
10. Adjust external PEEP valve to desired setting. Depress PEEP OFF/ON Pushbutton to activate PEEP AUTOmatic mode.
11. Connect Patient Valve to patient.
12. Do not leave patient unattended until desired operation is verified.

CAUTION: Possible explosion hazard if used in the presence of flammable anesthetics.

DO NOT remove equipment covers. Refer servicing to qualified personnel only.

FLOW	INSPIRATORY TIME (SEC)								
ml/SEC	0.2	0.4	0.6	0.8	1.0	1.5	2.0	2.5	3.0
100	20	40	60	80	100	150	200	250	300
200	40	80	120	160	200	300	400	500	600
300	60	120	180	240	300	450	600	750	900
400	80	160	240	320	400	600	800	1000	1200
500	100	200	300	400	500	750	1000	1250	1500
600	120	240	360	480	600	900	1200	1500	1800
700	140	280	420	560	700	1050	1400	1750	2100
800	160	320	480	640	800	1200	1600	2000	2400
900	180	360	540	720	900	1350	1800	2250	2700
1000	200	400	600	800	1000	1500	2000	2500	3000
1100	220	440	660	880	1100	1650	2200	2750	3300
1200	240	480	720	960	1200	1800	2400	3000	3600
1300	260	520	780	1040	1300	1950	2600	3250	3900
1400	280	560	840	1120	1400	2100	2800	3500	4200
1500	300	600	900	1200	1500	2250	3000	3750	4500
1600	320	640	960	1280	1600	2400	3200	4000	4800

TIDAL VOLUME COMPUTATION CHART

Figure 1-9. Instruction decal.

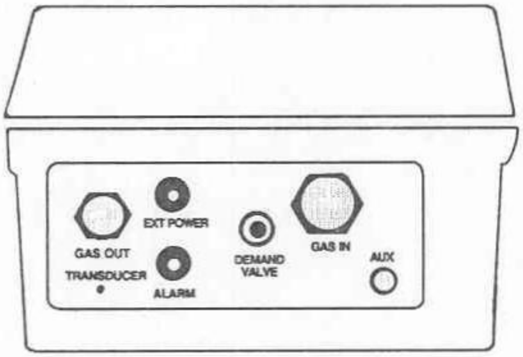


Figure 1-10. Connector panel markings.

1-14. Model differences.

Generalized model differences are identified in table 1-4. Other disassembly, assembly, and component differences are identified in chapter 4, sections VII and VIII.

NOTE

The internal layout of modules or assemblies varies between the two models, but they are electronically equivalent.

Table 1-4. Model differences.

Component/part	Model 750	Model 750M
Battery compartment cover latches	Rotary knobs	Spring clips
Battery fastener	Hook-and-loop strap	Plastic holder
Case (colors)	Black, light gray, and white	Black, medium gray, and light gray
Connector panel (lettering)	Molded	Painted
Control module mount	Gray slide	Black slide
Control module protective cover	Edge lips, finished edges	Straight, unfinished edges
Cover hinge	Plastic	Metal
Cover latch	Rotary knob	Metallic slide
Transducer hose barb	Plastic	Metal

1-15. Safety, care, and handling.

a. Observe each WARNING, CAUTION, and NOTE in this manual.

b. Ensure that caution is used when operating the ventilator with the multivoltage power supply to avoid electrical shock hazards.

c. When operating the ventilator in a wet environment, operators should take precautions and protect it with a cover.

WARNING

Do not enclose the ventilator in an impermeable plastic bag.

d. Do not use the ventilator near flammable anesthetics to preclude an explosion hazard.

e. This device will only be used by qualified medical personnel or persons under the instruction and guidance of a physician.

Section III. PRINCIPLES OF OPERATION

1-16. Basic operation.

The volume ventilator consists of a breathing circuit, controls, monitors, and alarms. Operating modes and supportive functions of the ventilator are as follows:

a. Control mode. This mode regulates the patient's breathing and does not allow the patient to breathe spontaneously. The control mode features provide uniform ventilation over a broad, selectable range to meet each patient's ventilatory needs.

b. Assist mode. This mode is designed for a patient who has difficulty breathing but who can initiate inspiration. The assist mode permits patient-controlled ventilation. Each assisted ventilation occurs when a patient-initiated breath reaches a preset negative pressure threshold setting (referenced to end pressure). The ventilator will generate controlled ventilation if the patient's spontaneous breathing rate falls below its ventilation rate setting.

c. Synchronized intermittent mandatory ventilation (SIMV) mode. This mode permits a patient to breathe spontaneously while periodically receiving mandatory ventilation. Ambient air may be pulled through the patient valve's antiasphyxiation port (or optional demand valve connection). The spontaneously breathing patient is allowed to pull breathing gas through the antiasphyxiation port at the patient's own rate/inspiratory time.

d. PEEP. This function may be used with all previous modes of operation, although it is generally used with the control mode. This function is achieved by restricting or prohibiting the exhalation of gases through the exhaust port after a prescribed pressure limit has been reached, thereby keeping the lungs at a positive pressure at the end of each expiration. This function is often used to increase the patient's arterial oxygen saturation without increasing the inspired oxygen percentage.

1-17. Controls, indicators, displays, and alarms.

The controls, indicators, displays, and alarms are illustrated in figure 1-11.

a. Controls. The primary controls of the ventilator are related to breathing rate, time, and flow. A detailed explanation of each control and its interrelation is provided in paragraph 2-2.

b. Indicators and displays. A variety of indicators and displays is provided on the control module to monitor both the patient's condition and the ventilator's operation. A detailed explanation of each indicator and display is provided in paragraph 2-4.

c. Alarms. Audible and visual alarms monitor a wide range of potentially hazardous conditions. These alarms and their operations are explained in paragraph 2-23.

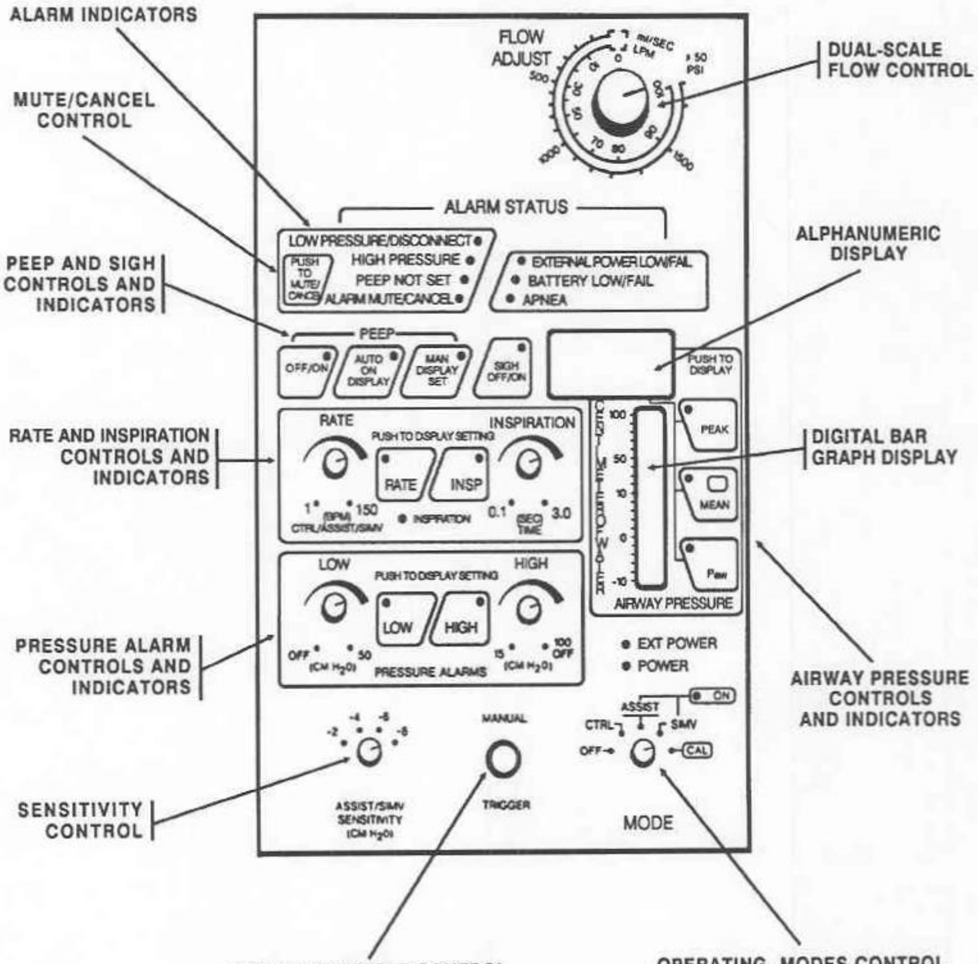

ALARM INDICATORS
MUTE/CANCEL CONTROL
PEEP AND SIGH CONTROLS AND INDICATORS
RATE AND INSPIRATION CONTROLS AND INDICATORS
PRESSURE ALARM CONTROLS AND INDICATORS
SENSITIVITY CONTROL
MANUAL OVERRIDE CONTROL
OPERATING MODES CONTROL
AIRWAY PRESSURE CONTROLS AND INDICATORS
DIGITAL BAR GRAPH DISPLAY
ALPHANUMERIC DISPLAY
DUAL-SCALE FLOW CONTROL
FLOW ADJUST
ALARM STATUS
LOW PRESSURE/DISCONNECT
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
PUSH TO MUTE/CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
OFF/ON
AUTO ON DISPLAY
MAN DISPLAY SET
SIGH OFF/ON
PUSH TO DISPLAY
RATE
INSPIRATION
PUSH TO DISPLAY SETTING
RATE
INSP
CTRL/ASSIST/SIMV
PEAK
MEAN
AIRWAY PRESSURE
LOW
HIGH
PRESSURE ALARMS
EXT POWER
POWER
MANUAL
TRIGGER
ASSIST/SIMV SENSITIVITY (CM H2O)
ASSIST
CTRL
SIMV
OFF
ON
CAL
MODE

Figure 1-11. Controls, indicators, displays, and alarms.

1-18. Patient valve operation (fig 1-12).

a. *Inspiration cycle*. Ventilator controlled gas, originating at the control module, enters the patient valve through the gas inlet port. The diaphragm valve inflates, occludes the exhaust port, and causes all gas to flow to the patient by way of hoses and a face mask, endotracheal or tracheostomy tube.

NOTE

Leaf valve #1 opens, leaf valve #2 closes the antiasphyxiation port to the atmosphere, and leaf valve #3 prevents the flow of gas through the exhaust port during spontaneous respirations.

b. *Expiration cycle*. Expired gas from the patient flows through the face mask, hoses, and patient interface connection of the patient valve. The diaphragm valve deflates, allowing exhaled gas to flow through the exhaust port to the atmosphere.

NOTE

Leaf valves #1 and #2 close ensuring that the patient's exhaled gas can only flow through the exhaust port. Leaf valve #3 opens to allow the flow of exhaled gas to the atmosphere.

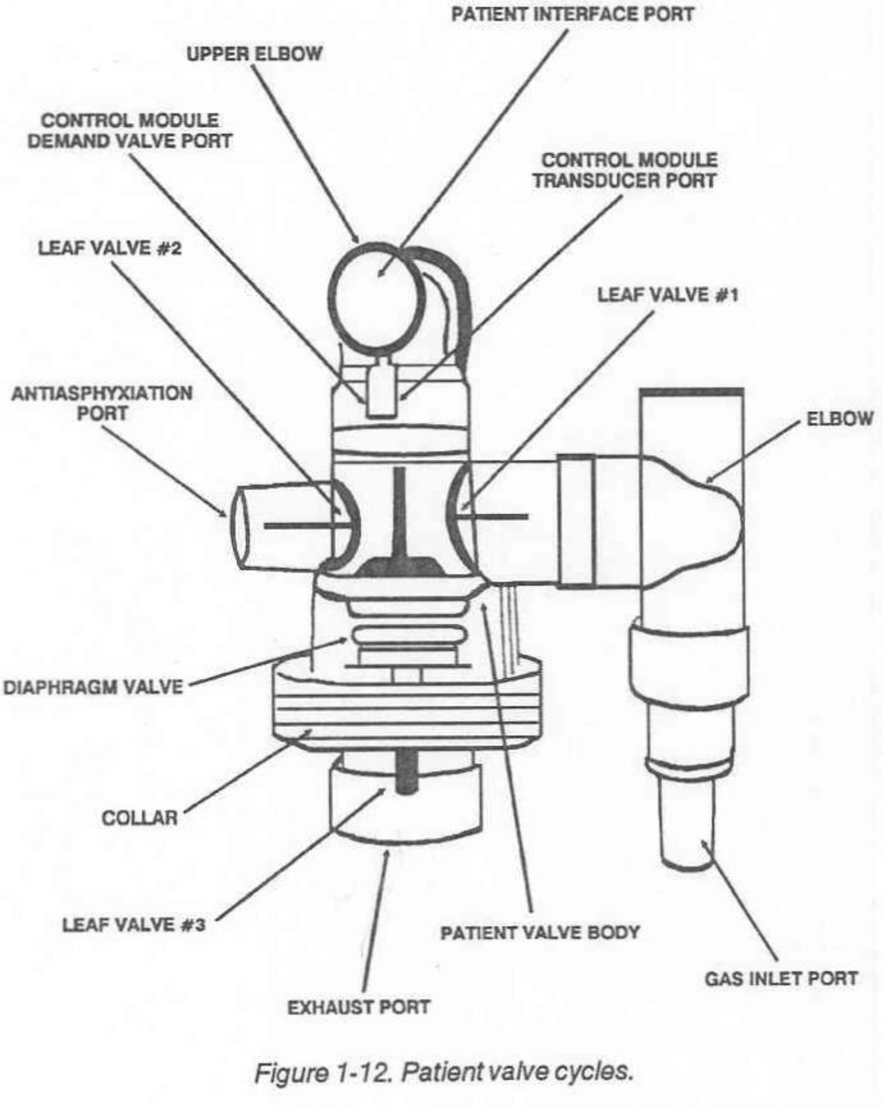

PATIENT INTERFACE PORT
UPPER ELBOW
CONTROL MODULE DEMAND VALVE PORT
CONTROL MODULE TRANSDUCER PORT
LEAF VALVE #2
LEAF VALVE #1
ANTIASPHYXIATION PORT
ELBOW
DIAPHRAGM VALVE
COLLAR
LEAF VALVE #3
PATIENT VALVE BODY
GAS INLET PORT
EXHAUST PORT

Figure 1-12. Patient valve cycles.

CHAPTER 2

OPERATING INFORMATION AND INSTRUCTIONS

Section I. CONTROLS

2-1. General.

a. Ventilator control settings are based on a 50-psi input pressure.

b. Controls include rotary knobs, membrane switches, and a push-button switch.

2-2. Description of controls (fig 2-1).

a. FLOW ADJUST control.

(1) The rotary flow control can be used with 100 percent medical-grade oxygen, medical-grade air, or blended mixtures of oxygen and air. Specific applications may require the use of blended combinations to achieve oxygen concentrations between 22 and 99 percent oxygen. Refer to chapter 3 for information and operating instructions for a blender.

(2) The control is marked in liters per minute (lpm) and milliliters per second (mL/sec) scales.

(3) The deliverable tidal volume can be calculated by multiplying the FLOW ADJUST control setting (using the mL/sec scale) by the INSPIRATION TIME control setting (seconds or fractions of seconds).

NOTE

Example: The FLOW ADJUST control is set at 1000 mL/sec and the INSPIRATION TIME control is set at 0.5 SEC. Therefore, deliverable tidal volume equals 1000 X 0.5 or 500 mL.

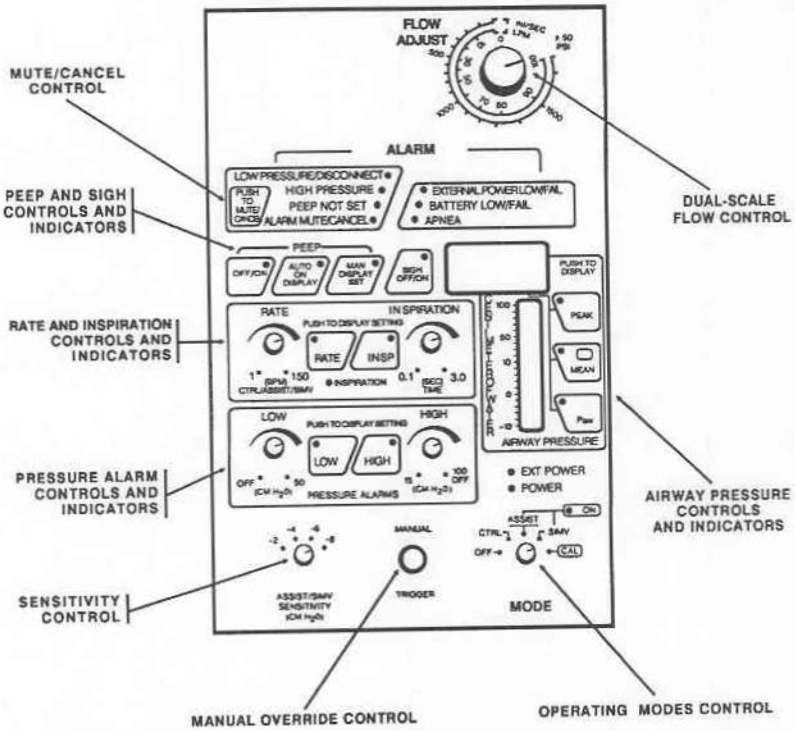

MUTE/CANCEL CONTROL
PEEP AND SIGH CONTROLS AND INDICATORS
RATE AND INSPIRATION CONTROLS AND INDICATORS
PRESSURE ALARM CONTROLS AND INDICATORS
SENSITIVITY CONTROL
MANUAL OVERRIDE CONTROL
OPERATING MODES CONTROL
AIRWAY PRESSURE CONTROLS AND INDICATORS
DUAL-SCALE FLOW CONTROL
FLOW ADJUST
ALARM
LOW PRESSURE/DISCONNECT
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
SIGH OFF/ON
RATE
INSPIRATION
RATE
INSP
LOW
HIGH
AIRWAY PRESSURE
PEAK
MEAN
EXT POWER
POWER
MANUAL
TRIGGER
ASSIST/SIMV SENSITIVITY
MODE
ASSIST
CTRL
SIMV
OFF
CAL
ON

Figure 2-1. Controls.

b. MODE selector switch.

(1) This five-position rotary switch provides operating electrical power and operational features for the following positions (except off).

(a) CTRL (control).

(b) ASSIST.

(c) SIMV.

(d) CAL (calibration).

(2) An indicator is illuminated in the ASSIST and SIMV positions.

(3) Turning the MODE selector switch to CTRL, ASSIST, or SIMV causes the microprocessor to perform a self-test. (Refer to para 2-12.)

(4) The airway transducer is calibrated in the CAL position.

c. RATE control.

(1) This rotary control (with a light gray collet on the knob) is used to select a ventilation rate during CTRL, ASSIST, and SIMV modes of operation. The control settings vary from 1 to 150 breaths per minute (BPM).

(2) During CTRL MODE operation, the ventilator cycles based on its RATE, INSPIRATION TIME, and FLOW ADJUST settings.

(3) In ASSIST MODE operation, the ventilator cycles based on its RATE, INSPIRATION TIME, and FLOW ADJUST settings identical to the CTRL MODE. However, patient initiated breaths, sensed by negative pressure deflection, cause the ventilator to deliver an assisted ventilation at its FLOW ADJUST and INSPIRATION TIME settings only.

NOTE

Controlled ventilations are delivered when there are no spontaneous respirations or the patient's spontaneous breathing rate falls below the RATE setting.

(4) In the SIMV MODE of operation, the ventilator will intermittently deliver a controlled breath at the RATE control setting synchronized to the patient's spontaneous respiration.

NOTE

A patient normally breathes at an individually spontaneous rate and volume, but when it is time for a controlled breath to be delivered, it is synchronized with the patient's next inspiration.

d. RATE display switch. This membrane switch activates the alphanumeric display to show the RATE setting.

e. INSPIRATION TIME control.

(1) This rotary control (with a light gray collet on the knob) sets the inspiratory duration for all ventilator-delivered breaths.

(2) The control is adjustable in 0.1-second increments from 0.1 to 3.0 seconds. Its range is limited by the RATE control setting.

NOTE

An inverse inspiratory time/expiratory time (I:E) ratio is not permitted.

f. INSP display switch. This membrane switch activates the alphanumeric display to show the INSPIRATION TIME setting.

g. LOW PRESSURE ALARM control.

(1) This rotary control (with a red collet on the knob) is used to select the low pressure activation point.

(2) The control has an absolute range from 0 to 50 cm H_2O.

h. LOW PRESSURE ALARM display switch. This membrane switch activates the alphanumeric display to show the low pressure alarm setting.

i. HIGH PRESSURE ALARM control.

(1) This rotary control (with a red collet on the knob) is used to select the high pressure activation point and peak inspiratory pressure relief mechanism.

(2) The control has an absolute range from 15 to 100 cm H_2O.

j. HIGH PRESSURE ALARM display switch. This membrane switch activates the alphanumeric display to show the high pressure alarm setting.

k. ASSIST/SIMV SENSITIVITY switch.

(1) This four-position switch sets the ASSIST/SIMV triggering threshold. Its setting determines how much negative deflection a spontaneously breathing patient must generate before the ventilator delivers an assisted ventilation.

(2) The switch has a range of -2 to -8 cm H_2O below end expiratory pressure.

l. MANUAL TRIGGER switch.

(1) This push-button switch overrides automatic operation. When depressed, it permits gas flow at the rate control setting and functions in all operating modes. When released, resynchronization occurs by allowing a full exhalation period to occur before timed breaths resume.

(2) The MANUAL TRIGGER serves as a back-up method to provide manually triggered ventilations if an electronics failure occurs in the primary system of the control module.

(3) This push-button switch is protected against accidental contact by a circular guard.

NOTE

The MANUAL TRIGGER operation is designed to bypass the peak inspiratory pressure relief mechanism and close leaf valve #3.

m. SIGH OFF/ON switch.

(1) This membrane switch permits operation with or without SIGH. When activated, a SIGH ventilation is initiated and then repeats once every 100 ventilations or 7 minutes, whichever occurs first.

(2) Each SIGH ventilation equals 150 percent of the INSPIRATION TIME setting, which increases the delivered volume by 50 percent.

NOTE

As a safety precaution, the ventilator will automatically truncate SIGH to a combined maximum of 3 seconds.

n. PEEP OFF/ON switch. This membrane switch provides a means of converting the sensitivity control pressure reference from atmospheric pressure to atmospheric pressure plus PEEP pressure.

o. PEEP AUTO ON/DISPLAY switch. This membrane switch activates automatic monitoring of PEEP and activates the alphanumeric display to show the current PEEP pressure.

p. PEEP MAN DISPLAY/SET switch. This membrane switch activates the alphanumeric display and allows a PEEP reference to be entered manually. In this mode, PEEP is not monitored.

q. PEAK AIRWAY PRESSURE switch. This membrane switch activates the alphanumeric display and shows the peak pressure of the most recent respiration.

r. MEAN AIRWAY PRESSURE switch. This membrane switch activates the alphanumeric display and shows the average airway pressure. The microprocessor stores mean airway pressure data in five buffers pertinent to the most recent five respirations. Buffers are referred to as 0 through 4, with 0 representing the most recent respiration. The INSPIRATION TIME setting determines how the mean airway pressure is calculated in table 2-1.

Table 2-1. Mean airway pressure calculations.

INSPIRATION TIME	CALCULATION
<1 second	$\frac{(\text{buffers } 0 + 1)}{2}$
>1 second; <2.5 seconds	$\frac{\frac{(\text{buffers } 0 + 1 + 2 + 3)}{4} + (\text{buffer } 4)}{2}$
>2.5 seconds	$\frac{(\text{buffers } 0 + 1 + 2 + 3 + 4)}{5}$

s. P_{aw} AIRWAY PRESSURE switch. This membrane switch activates the alphanumeric display and shows the current airway pressure (P_{aw}). The numerical value of P_{aw} will scroll upwards and downwards as the pressure changes.

t. ALARM STATUS PUSH TO MUTE/CANCEL switch.

(1) *Muting*. This membrane switch mutes the audible alarm condition for a predetermined period. The muting is reset when the current alarm condition no longer exists or the predetermined mute period is reached.

(2) *Cancelling*. The switch operates differently with apnea. When depressed, it cancels the audible and visual APNEA ALARM STATUS and the special assist mode which is automatically invoked at the onset of apnea. Cancellation of the apnea alarm allows the ventilator to resume operation at the current ASSIST or SIMV MODE setting.

Section II. INDICATORS AND DISPLAYS

2-3. General.

a. Control module indicators are either momentarily or continuously illuminated. This section will use the letters (M) for momentarily illuminated and (C) for continuously illuminated.

b. The alphanumeric display will normally illuminate for three seconds and then blank to conserve battery electrical power. It will, however, illuminate continuously under various alarm conditions.

c. The small indicators show in the illustrations as black circles, but are either green or red (alarm color).

2-4. Descriptions of indicators and displays (fig 2-2).

a. EXTERNAL POWER LOW/FAIL alarm lamp (C). This lamp illuminates upon sensing an interruption or failure of the external electrical power.

b. BATTERY LOW/FAIL alarm lamp (C). This lamp illuminates upon sensing a low battery condition (11 VDC).

c. APNEA alarm lamp (C). This lamp operates only when no combination of positive and/or negative deflections occur within a predetermined monitoring period. The apnea lamp (and audible alarm) is operable only in the ASSIST and SIMV modes of operation.

d. SIGH OFF/ON indicator lamp (C). This lamp illuminates when the SIGH OFF/ON membrane switch is depressed to the on position.

e. PEAK AIRWAY PRESSURE indicator lamp (M). This lamp is illuminated when the PEAK membrane switch is depressed to the on position.

f. MEAN AIRWAY PRESSURE indicator lamp (M). This lamp is illuminated when the MEAN membrane switch is depressed to the on position.

g. P_{aw} AIRWAY PRESSURE indicator lamp (M). This lamp is illuminated when the P_{aw} membrane switch is depressed to the on position.

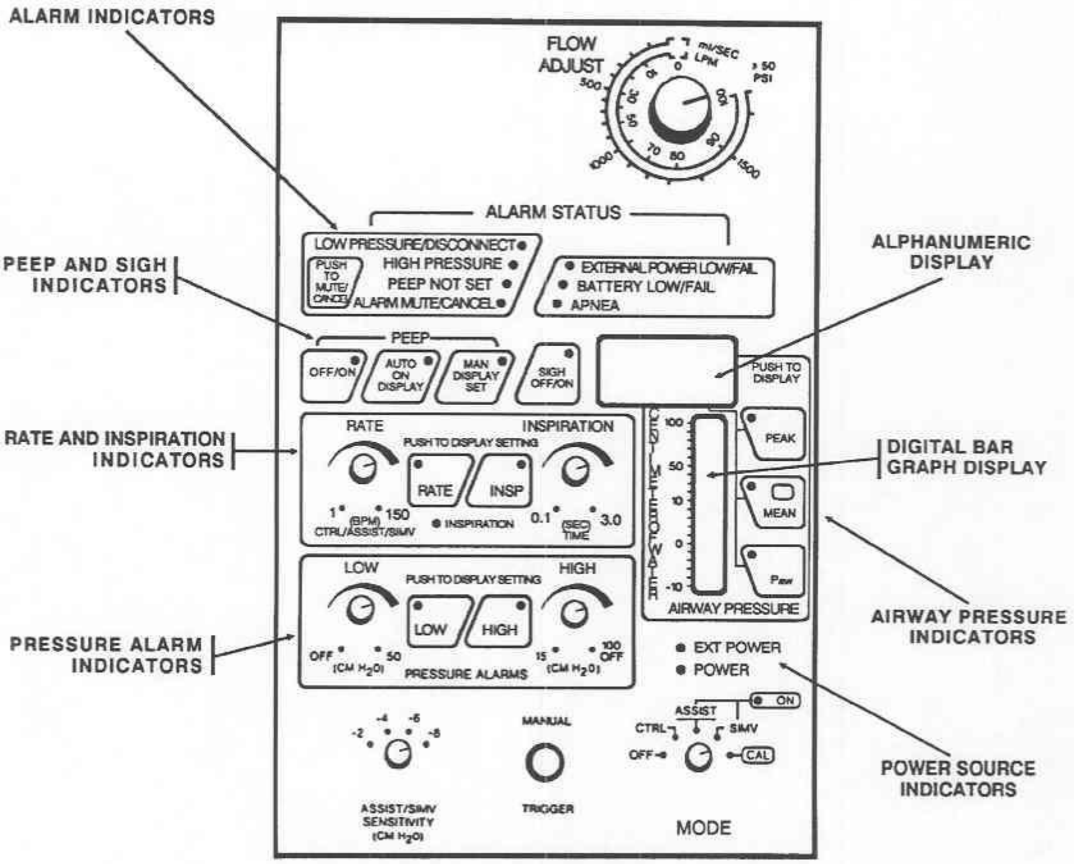

ALARM INDICATORS
PEEP AND SIGH INDICATORS
RATE AND INSPIRATION INDICATORS
PRESSURE ALARM INDICATORS
ALPHANUMERIC DISPLAY
DIGITAL BAR GRAPH DISPLAY
AIRWAY PRESSURE INDICATORS
POWER SOURCE INDICATORS
FLOW ADJUST
ml/SEC
LPM
> 50 PSI
0
10
30
50
70
80
90
100
500
1000
1500
ALARM STATUS
LOW PRESSURE/DISCONNECT
PUSH TO MUTE/CANCEL
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
OFF/ON
AUTO ON DISPLAY
MAN DISPLAY SET
SIGH OFF/ON
PUSH TO DISPLAY
RATE
INSPIRATION
PUSH TO DISPLAY SETTING
RATE
INSP
1
150
(BPM)
CTRL/ASSIST/SIMV
INSPIRATION
0.1
3.0
(SEC) TIME
CENTIMETER OF WATER
100
50
10
0
-10
PEAK
MEAN
Paw
AIRWAY PRESSURE
LOW
HIGH
PUSH TO DISPLAY SETTING
LOW
HIGH
OFF
50
(CM H2O)
PRESSURE ALARMS
15
100 OFF
(CM H2O)
EXT POWER
POWER
-2
-4
-6
-8
ASSIST/SIMV SENSITIVITY (CM H2O)
MANUAL
TRIGGER
ON
ASSIST
CTRL
SIMV
OFF
CAL
MODE

Fig 2-2. Indicators and displays.

h. EXT POWER indicator lamp (C). This lamp illuminates when the ventilator is connected to an external electrical power source.

i. POWER indicator lamp (C). This lamp illuminates when the MODE selector switch is in any position except OFF. The microprocessor validates the available electrical power sources during the self-test.

j. ASSIST/SIMV indicator lamp (C). This lamp illuminates when either ASSIST or SIMV MODE of operation is selected.

NOTE

The ASSIST/SIMV indicator lamp will not illuminate during apnea.

k. HIGH PRESSURE ALARM indicator lamp (M). This lamp is illuminated when the HIGH membrane switch is depressed or the HIGH PRESSURE ALARM control setting is adjusted.

l. LOW PRESSURE ALARM indicator lamp (M). This lamp is illuminated when the LOW membrane switch is depressed or the LOW PRESSURE ALARM control setting is adjusted.

m. INSPIRATION indicator lamp (M). This lamp illuminates during the inspiratory cycle of all ventilator-generated breaths in all operating modes.

n. INSP indicator lamp (M). This lamp illuminates when the INSP membrane switch is depressed or the INSPIRATION TIME control setting is adjusted.

o. RATE indicator lamp (M). This lamp illuminates when the RATE membrane switch is depressed or the RATE control setting is adjusted.

p. PEEP MAN DISPLAY/SET indicator lamp (C). This lamp illuminates when the PEEP MAN DISPLAY/SET membrane switch is depressed to the on position.

q. PEEP AUTO ON/DISPLAY indicator lamp (C). This lamp illuminates when the PEEP AUTO ON/DISPLAY membrane switch is depressed to the on position.

r. PEEP OFF/ON indicator lamp (C). This lamp illuminates when the PEEP OFF/ON membrane switch is depressed to the on position.

s. ALARM MUTE/CANCEL indicator lamp (C). This lamp illuminates when the PUSH TO MUTE/CANCEL membrane switch is depressed during an alarm condition and remains illuminated during the mute/cancel period.

t. PEEP NOT SET alarm lamp (C). This lamp illuminates when the required PEEP criterion is not met for three consecutive respiratory cycles.

u. HIGH PRESSURE alarm lamp (C). This lamp illuminates when the HIGH PRESSURE ALARM activation threshold has been met.

v. LOW PRESSURE/DISCONNECT alarm lamp (C). This lamp illuminates when the LOW PRESSURE ALARM activation threshold has been met or when a disconnection occurs in the patient circuit.

w. Alphanumeric display (C). The display activates when the following conditions occur:

(1) The combined RATE and INSPIRATION TIME control settings create an inverse I:E ratio condition. When activated, the display alternately flashes "-IE" and blanks.

(2) The memory test portion of the self-test fails. When activated, the display shows "FAL."

(3) The pressure transducer zero baseline exceeds ± 1 cm H_2O. When activated, the display alternately flashes "---" and the current transducer calibration value.

(4) The pressure transducer calibration is prematurely stopped. When activated, the display alternately flashes "---" and the current transducer calibration value.

(5) The microprocessor fails during operation or a continuous pressure above 100 cm H_2O is detected in the patient circuit. When activated, the display shows "FAL."

x. Digital bar graph display (C). The bar graph continuously displays airway pressure. When a patient disconnection occurs, the bar graph lamp, which corresponds to a reading between 0 and 2 cm H_2O, will remain illuminated.

Section III. CONNECTIONS

2-5. Control module connector panel (fig 2-3).

a. The connector panel, located on the top end of the control module, contains all patient valve and multivoltage power supply connections. The audible alarm speaker is also located on this panel.

b. The connector panel includes—

(1) GAS IN, a diameter indexed safety system (DISS), male thread, oxygen fitting;

(2) GAS OUT, a low-pressure, 10-mm male tapered barb;

(3) TRANSDUCER, a low-pressure, 1/8-in hose barb;

(4) DEMAND VALVE, a low-pressure, 3/16-in hose barb;

(5) EXT POWER, an electrical jack for connecting the multivoltage power supply; and

(6) AUX, an electrical jack to interface with an external compressor.

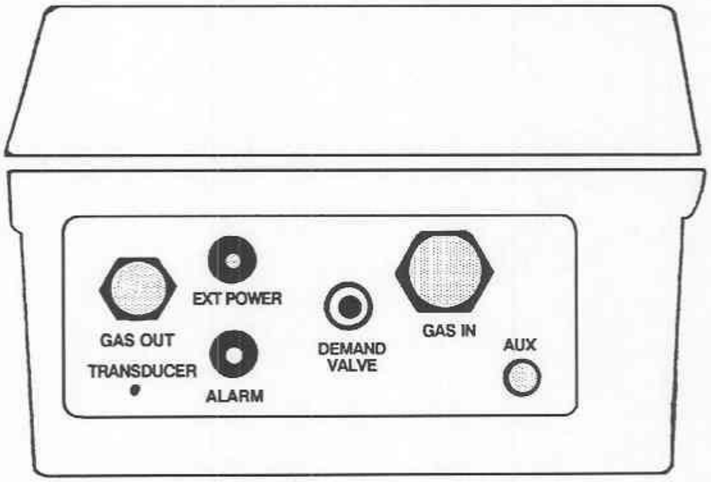


Fig 2-3. Connector panel.

2-6. Patient valve (fig 2-4).

The patient valve includes the following connections:

a. Gas inlet port. This port is a valved, 18-mm male, tapered connection on the removable elbow which attaches to the patient valve body.

b. Antiasphyxiation port. This port is a valved, 15-mm male, tapered connection.

c. Exhaust port. The exhaust port is a tapered, 22-mm id/30-mm od fitting incorporating a check valve.

d. Patient interface port. This port, located on the permanently attached upper elbow, is a 15-mm id/22-mm od tapered port.

e. Demand valve port. This port is a 3⁄16-in id hose fitting.

f. Transducer port. This port is a 1⁄8-in id hose fitting.

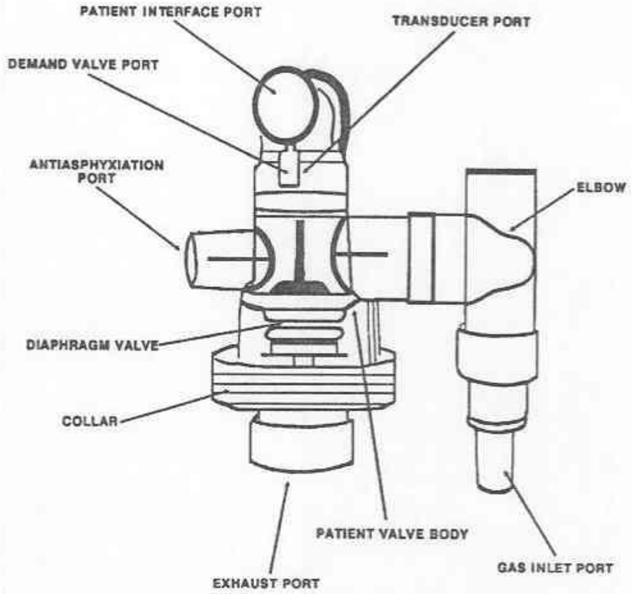

PATIENT INTERFACE PORT
TRANSDUCER PORT
DEMAND VALVE PORT
ANTIASPHYXIATION PORT
ELBOW
DIAPHRAGM VALVE
COLLAR
PATIENT VALVE BODY
GAS INLET PORT
EXHAUST PORT

Figure 2-4. Patient valve connections.

2-7. Multivoltage power supply (fig 2-5).

The multivoltage power supply includes the following:

a. Electrical AC power cord assembly for connection to a 115-VAC/230-VAC source of power.

b. Electrical DC power cord assembly for connection to the control module for operation of the ventilator using an external source of electrical power.

c. Electrical power cord for use with an external 11-30 VAC or VDC source of electrical power.

NOTE

> A mating connector is required to match the electrical receptacle on the external 11-30 VAC/VDC source of electrical power.

d. Electrical power cable assembly for operation of the ventilator using a vehicular source of 12VDC electrical power.

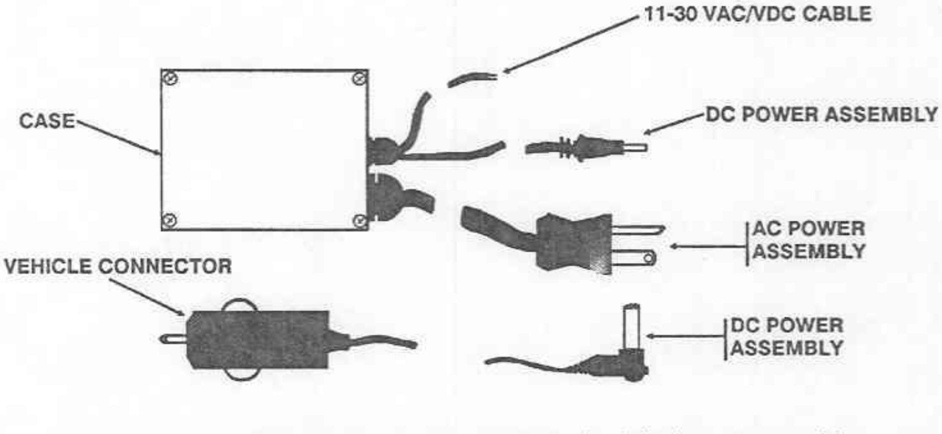

11-30 VAC/VDC CABLE
CASE
DC POWER ASSEMBLY
AC POWER ASSEMBLY
VEHICLE CONNECTOR
DC POWER ASSEMBLY

Figure 2-5. Multivoltage power supply and vehicular power cable.

Section IV. ASSEMBLY, INTERCONNECTIONS, AND INITIAL ADJUSTMENTS

2-8. Assembly.

No assembly is required before placing the ventilator into operation except for battery pack installation, if removed during period of non-use or storage. Refer to paragraphs 4-19b(8) or 4-22b(7) for battery pack installation instructions.

2-9. Interconnections (fig 2-6).

Procedures for interconnecting the various sources of oxygen, air, or blended combination of the gases; the control module; the patient valve; other optional accessories; and the multivoltage power supply are as follows:

a. Connect either the green high pressure hose from the external gas source or appropriate tubing from a blender to the GAS IN fitting on the connector panel of the control module.

NOTE

Detailed procedures for interconnecting a blender are provided in chapter 3.

b. Connect the 10-mm spiral hose between the GAS OUT tapered barb on the connector panel of the control module and the gas inlet port of the patient valve.

c. Connect the 1⁄8-in id hose between the TRANSDUCER hose barb on the connector panel of the control module and the transducer port of the patient valve.

d. Connect the 3⁄16-in id hose between the DEMAND VALVE barb on the connector panel of the control module and the demand valve port of the patient valve.

e. If an external source of electrical power is available, connect either one of the following:

(1) The electrical 12-VDC power cord assembly, from the multivoltage power supply, to the EXT POWER jack on the connector panel of the control module.

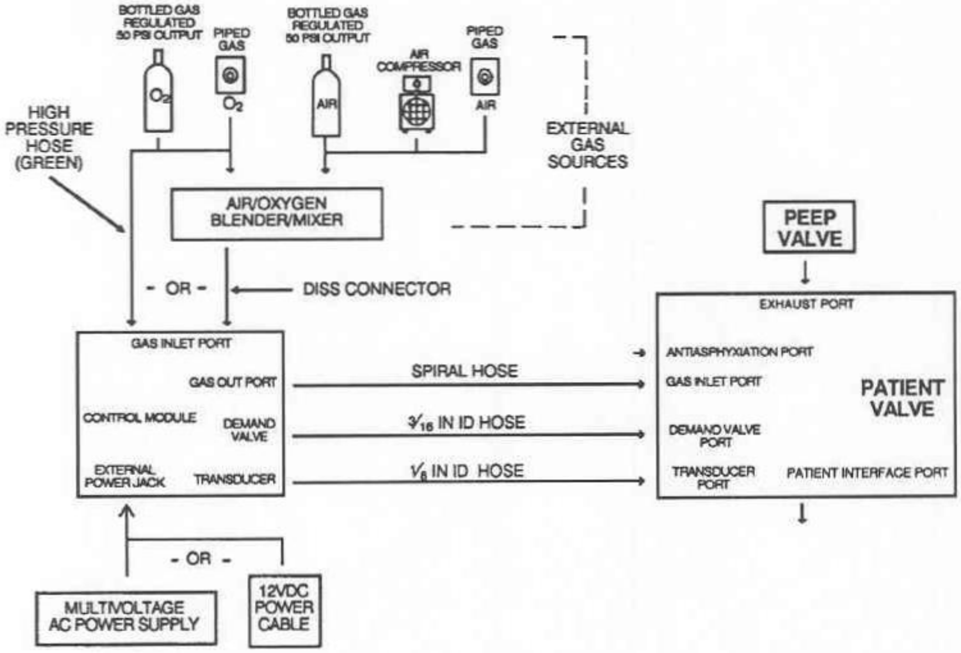

BOTTLED GAS REGULATED 50 PSI OUTPUT
PIPED GAS
O_2
O_2
BOTTLED GAS REGULATED 50 PSI OUTPUT
AIR
AIR COMPRESSOR
PIPED GAS
AIR
HIGH PRESSURE HOSE (GREEN)
EXTERNAL GAS SOURCES
AIR/OXYGEN BLENDER/MIXER
PEEP VALVE
- OR -
DISS CONNECTOR
EXHAUST PORT
GAS INLET PORT
GAS OUT PORT
CONTROL MODULE
DEMAND VALVE
EXTERNAL POWER JACK
TRANSDUCER
SPIRAL HOSE
3⁄16 IN ID HOSE
1⁄8 IN ID HOSE
ANTIASPHYXIATION PORT
GAS INLET PORT
DEMAND VALVE PORT
TRANSDUCER PORT
PATIENT VALVE
PATIENT INTERFACE PORT
- OR -
MULTIVOLTAGE AC POWER SUPPLY
12VDC POWER CABLE

Figure 2-6. Interconnections.

(2) The electrical 12-VDC power cable between the EXT POWER jack on the connector panel of the control module and a vehicular source of 12-VDC electrical power.

2-10. Initial adjustments.

a. Adjust the voltage selector switch, located on the end of the multivoltage power supply near the power cord assemblies, to match either the nominal voltage of 110 VAC or 230 VAC.

b. Adjust the external gas sources to 50-psi output.

CAUTION

The FLOW ADJUST control on the control module is calibrated to a 50-psi input pressure.

Section V. INITIAL SETUP, SELF-TEST, AND CALIBRATION

2-11. Initial setup.

a. The initial setup of the ventilator is accomplished by following the interconnection procedures and the initial adjustments in paragraphs 2-9 and 2-10.

b. Additional configuration interconnections, with optional accessories, are illustrated in figures 2-7 and 2-8.

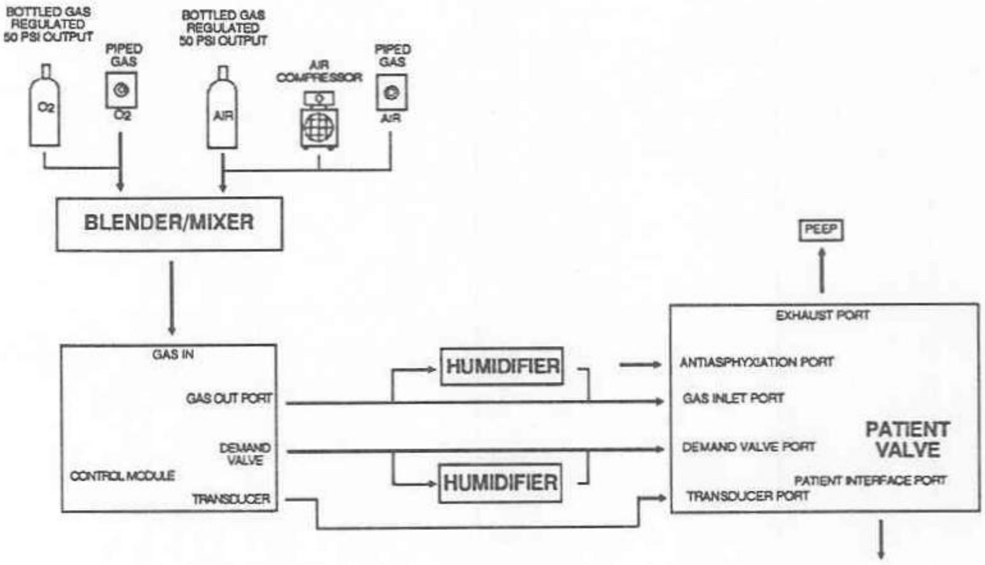

BOTTLED GAS
REGULATED
50 PSI OUTPUT
PIPED
GAS
O2
O2
BOTTLED GAS
REGULATED
50 PSI OUTPUT
AIR
AIR
COMPRESSOR
PIPED
GAS
AIR
BLENDER/MIXER
PEEP
EXHAUST PORT
GAS IN
GAS OUT PORT
DEMAND
VALVE
CONTROL MODULE
TRANSDUCER
HUMIDIFIER
HUMIDIFIER
ANTIASPHYXIATION PORT
GAS INLET PORT
DEMAND VALVE PORT
PATIENT
VALVE
PATIENT INTERFACE PORT
TRANSDUCER PORT

Figure 2-7. Alternate blender/mixer configuration.

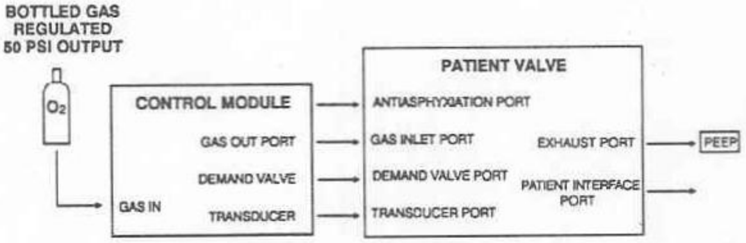

BOTTLED GAS
REGULATED
50 PSI OUTPUT
O2
CONTROL MODULE
GAS OUT PORT
DEMAND VALVE
GAS IN
TRANSDUCER
PATIENT VALVE
ANTIASPHYXIATION PORT
GAS INLET PORT
EXHAUST PORT
PEEP
DEMAND VALVE PORT
PATIENT INTERFACE
PORT
TRANSDUCER PORT

Figure 2-8. Alternate bottled gas configuration.

2-12. Self-test.

a. The ventilator undergoes a self-test process when the MODE selector switch is set to CTRL, ASSIST, or SIMV.

CAUTION

The self-test will only be performed with the patient valve disconnected from the patient.

b. The self-test process consists of interaction between the ventilator microprocessor and peripheral circuitry to verify external power/internal battery status, transducer calibration, and control module settings. The self-test begins by checking the external power/internal battery status and then the internal microprocessor memory. It then displays, in order, the current values of the following:

(1) Transducer calibration (only when calibration is required).

WARNING

The alphanumeric display will show "00" if the transducer is calibrated. Otherwise, the self-test will automatically alert attending personnel if the transducer calibration baseline (0) exceeds ± 1 cm H_2O. An audible tone will activate and the alphanumeric display will alternately flash "---" and the current transducer calibration value. Do not attempt patient use.

(2) RATE.

(3) INSPIRATION TIME.

(4) LOW PRESSURE ALARM.

(5) ASSIST/SIMV SENSITIVITY.

c. The self-test values show in the alphanumeric display for 1-second intervals. Their respective indicator lamps are also illuminated for 1-second intervals.

NOTE

The self-test is complete when the alphanumeric display blanks.

d. If the ventilator fails the microprocessor memory portion of the self-test, the alphanumeric display will continuously display "FAL" and a beeping alarm will activate. Turn the MODE selector switch to the OFF position and repeat the self-test. If the self-test fails again, notify your unit Medical Equipment Repairer.

WARNING

DO NOT ATTEMPT TO USE THE VENTILATOR ON THE PATIENT IF THE SELF-TEST FAILS.

2-13. Transducer calibration (fig 2-9).

a. The patient valve is connected to a pressure sensing element (transducer) in the control module which provides data input to the microprocessor. This data is stored in a serial, non-volative electrically erasable programmable read-only memory (EEPROM) which can remain for as long as 10 years. The transducer is calibrated to atmospheric pressure. During operation of the ventilator, the control module microprocessor will respond to pressure signals from the transducer which are compared to the control settings.

NOTE

Perform transducer calibration prior to using on each patient.

b. The transducer calibration procedures are as follows:

CAUTION

Do not connect the patient valve to the patient during this procedure.

(1) Set the MODE selector switch to CAL.

(2) Observe the control module displays for the following:

(a) The alphanumeric display is blank.

(b) The digital bar graph illuminates one or more indicator lamps.

(3) Depress and hold down the MEAN AIRWAY PRESSURE membrane switch for approximately 3 seconds.

NOTE

Releasing the membrane switch prematurely aborts the calibration process. A steady tone will start and the alphanumeric display will alternately flash "---" and the current transducer calibration value. The calibration procedure can be restarted by turning the MODE selector switch to the OFF position, turning it back to the CAL position, and beginning the calibration procedures again.

(4) Listen for a tone to start during the 3-second period.

(5) Observe that the alphanumeric display remains blank during the 3-second tone.

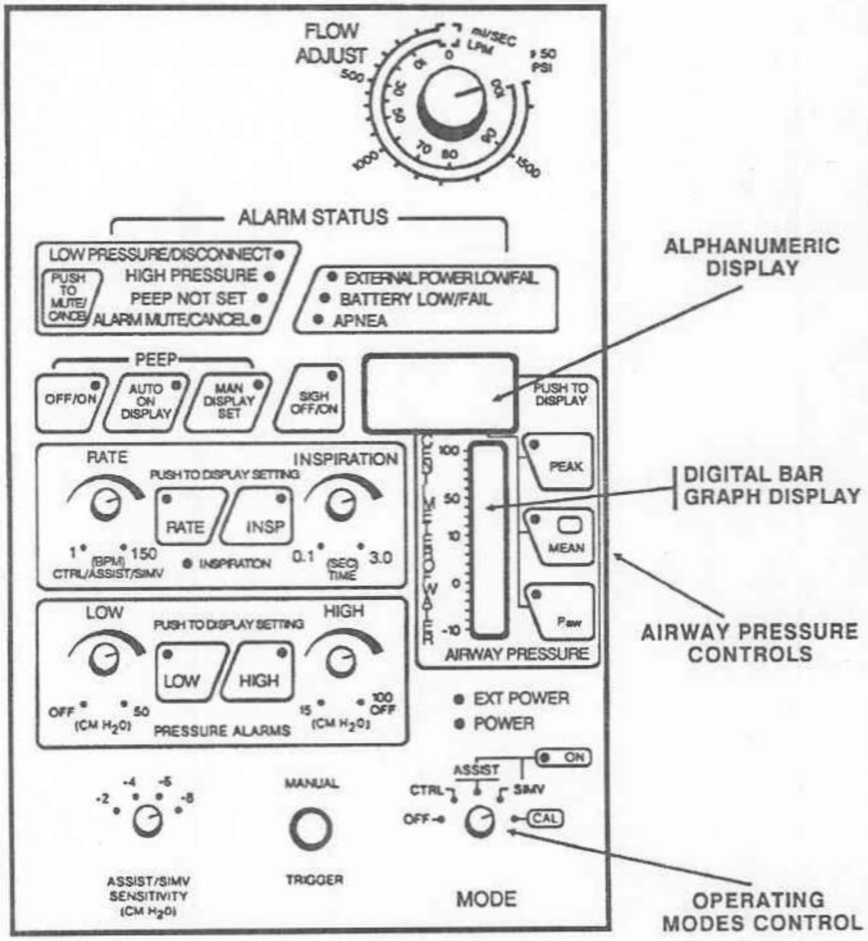

FLOW ADJUST
ml/SEC
LPM
50 PSI
500
1000
1500
ALARM STATUS
LOW PRESSURE/DISCONNECT
PUSH TO MUTE/ CANCEL
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
OFF/ON
AUTO ON DISPLAY
MAN DISPLAY SET
SIGH OFF/ON
PUSH TO DISPLAY
RATE
INSPIRATION
PUSH TO DISPLAY SETTING
RATE
INSP
(BPM)
CTRL/ASSIST/SIMV
INSPIRATION
(SEC) TIME
LOW
HIGH
PUSH TO DISPLAY SETTING
LOW
HIGH
(CM H2O)
PRESSURE ALARMS
CM H2O
PEAK
MEAN
Paw
AIRWAY PRESSURE
EXT POWER
POWER
ASSIST
ON
CTRL
SIMV
OFF
CAL
MANUAL
TRIGGER
ASSIST/SIMV SENSITIVITY (CM H2O)
MODE
ALPHANUMERIC DISPLAY
DIGITAL BAR GRAPH DISPLAY
AIRWAY PRESSURE CONTROLS
OPERATING MODES CONTROL

Figure 2-9. Transducer calibration.

(6) When the tone that started in step 4 stops, observe that—

(a) the alphanumeric display shows "00" and

(b) the digital bar graph lamp illuminates between 0 and 2 cm H_2O.

(7) Turn the MODE selector switch to another mode or to the OFF position.

NOTE

Functions which are dependent upon accurate pressure readings should only be used in conjunction with a protected airway. This will prevent gas leaks from distorting the pressure signals. Do not use pressure dependent functions with an unprotected airway. This applies primarily to use with uncuffed endotracheal tubes, tracheostomy tubes, and resuscitation masks where the face-to-mask-seal integrity is frequently compromised.

Section VI. MODES OF OPERATION

2-14. General.

a. Control settings on the control module may be adjusted at any time. In normal use, adjustments are typically made following the self-test.

b. Operating modes, with or without PEEP and SIGH functions, include CTRL, ASSIST, SIMV, and special assist-control backup during apnea.

2-15. CTRL MODE of operation (fig 2-10).

a. In CTRL MODE, the ventilator is used to establish a controlled breathing rate, inspiration time, and gas flow. Depending upon the application, the gas flow may consist of 100 percent medical-grade oxygen, medical-grade air, or a blended combination of both gases. The user may select operation with or without SIGH and with LOW or HIGH PRESSURE ALARM settings as well.

b. Establish control mode ventilation by completing the following actions:

(1) Turn the MODE selector switch to the CTRL position.

(2) Wait for the self-test to be completed.

(3) Observe that the control mode of operation begins cycling (upon completion of the self-test).

(4) Observe that the INSPIRATION indicator lamp illuminates during the inspiratory portion of each controlled ventilation.

NOTE

When control mode cycling begins, the LOW PRESSURE/DISCONNECT audible alarm and lamp will activate and remain on until the patient valve is connected to a patient and the transducer detects a pressure rise during the next ventilator-generated breath, or until the PUSH TO MUTE/CANCEL membrane switch is depressed.

(5) Adjust the FLOW ADJUST control as required.

(6) Adjust the RATE control setting as required.

(7) Adjust the INSPIRATION TIME control setting as required.

NOTE

Tidal volume can be quickly calculated by multiplying the FLOW ADJUST control setting (using the mL/sec scale) by the INSPIRATION TIME control setting in seconds or fractions of seconds. Refer to figure 1-9 or the decal affixed to the back of the control module for a tidal volume computation chart.

(8) Adjust the LOW PRESSURE ALARM setting, if required. Otherwise turn it to the OFF position.

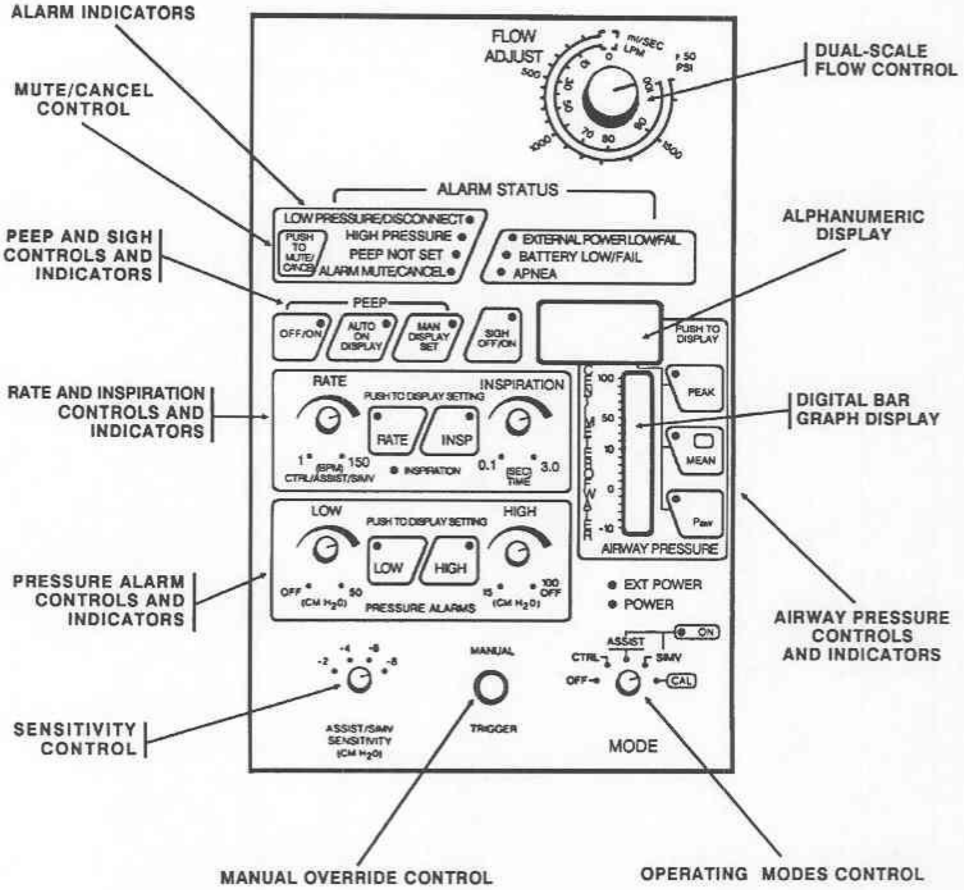

ALARM INDICATORS
MUTE/CANCEL CONTROL
PEEP AND SIGH CONTROLS AND INDICATORS
RATE AND INSPIRATION CONTROLS AND INDICATORS
PRESSURE ALARM CONTROLS AND INDICATORS
SENSITIVITY CONTROL
MANUAL OVERRIDE CONTROL
OPERATING MODES CONTROL
AIRWAY PRESSURE CONTROLS AND INDICATORS
DIGITAL BAR GRAPH DISPLAY
ALPHANUMERIC DISPLAY
DUAL-SCALE FLOW CONTROL
FLOW ADJUST
ml/SEC
LPM
50 PSI
ALARM STATUS
LOW PRESSURE/DISCONNECT
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
PUSH TO MUTE/CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
OFF/ON
AUTO ON DISPLAY
MAN DISPLAY SET
SIGH OFF/ON
PUSH TO DISPLAY
RATE
INSPIRATION
PUSH TO DISPLAY SETTING
RATE
INSP
1 (BPM) 150
CTRL/ASSIST/SIMV
INSPIRATION
0.1 (SEC) TIME 3.0
PEAK
MEAN
Paw
CM WATER
AIRWAY PRESSURE
LOW
HIGH
PUSH TO DISPLAY SETTING
OFF 50 (CM H2O)
15 100 OFF (CM H2O)
PRESSURE ALARMS
EXT POWER
POWER
-2 -4 -6 -8
ASSIST/SIMV SENSITIVITY (CM H2O)
MANUAL
TRIGGER
ASSIST
CTRL
SIMV
ON
OFF
CAL
MODE

Figure 2-10. CTRL MODE.

NOTE

> The disconnect portion of the LOW PRESSURE/DISCONNECT alarm capability will continue to function when the LOW PRESSURE ALARM is set to OFF.

(9) Adjust the HIGH PRESSURE ALARM setting, if required. Otherwise turn it to the OFF position.

NOTE

> When the HIGH PRESSURE ALARM is set to OFF, a 100-cm H_2O peak inspiratory pressure relief default remains active.

(10) Connect the patient's face mask, endotracheal tube, or tracheostomy tube to the patient valve.

(11) Attach the PEEP valve, if required, to the patient valve and adjust it to the required settings.

(12) Depress the PEEP OFF/ON membrane switch.

NOTE

> Excessive flows and/or inspiration times, occlusion of the patient circuit, or a change in the patient's physiological condition can cause a rise in inspiratory pressure. To safeguard the patient from high inspiratory pressures, the ventilator uses a protective peak inspiratory pressure relief system. Selection of a peak inspiratory pressure relief value corresponds to the HIGH PRESSURE ALARM control setting. When the HIGH PRESSURE ALARM control is set to OFF, a default of 100 cm H_2O is invoked. Airway pressure in excess of the peak setting is automatically vented to the atmosphere.

(13) Depress the SIGH OFF/ON membrane switch, if required.

NOTE

A SIGH ventilation is initiated and then repeated once every 100 ventilations or 7 minutes, whichever occurs first. Each SIGH ventilation equals 150 percent of the INSPIRATION TIME control setting. However, as a safety precaution, the ventilator will automatically truncate SIGH to a combined maximum of 3 seconds.

2-16. Augmented ventilation modes.

a. ASSIST and SIMV modes of operation are normally used in conjunction with a common gas source or blended gases. This permits the patient to receive controlled, assisted, and spontaneous ventilations from atmospheres of similar gas content.

CAUTION

Functions which are dependent upon accurate pressure readings should only be used in conjunction with a protected airway. This will prevent leaks from distorting the pressure signals. Augmented ventilation should only take place with a protected airway.

NOTE

Low ventilator flow rates can be masked during spontaneous breathing by entrainment of ambient air through the antiasphyxiation port on the patient valve. This can alter the fractional concentration of inspired oxygen (FIO_2) accuracy if breathing gas is furnished through a blender. Conversely, the patient's work to breathe to meet inspiratory needs will be lower. As a general rule, the ventilator's FLOW ADJUST settings should be verified for effectiveness. If the ventilator flow rate does not meet the patient's inspiratory requirements, a high-pitched whistle, caused by the opening of the antiasphyxiation port leaf valve, will be heard.

b. The SIMV synchronizing time interval works in conjunction with the ASSIST/SIMV SENSITIVITY control setting. The time interval is equal to 50 percent of the rate period (maximum of 8 seconds). The time interval is timed to open at 75 percent into the rate period and close when either the spontaneous breath is sensed or at 125 percent of the rate period, whichever occurs first. When 8-second time intervals occur, each time interval will open 4 seconds prior to the onset of each rate marker and close 4 seconds after the onset of each rate marker. When the time interval is opened, the ventilator looks for the next spontaneous breath to reach the ASSIST/SIMV SENSITIVITY control setting threshold. If a spontaneous breath is in process when the time interval is opened, the following operation prevails:

(1) If the patient's inspiratory pressure has not reached the ASSIST/SIMV SENSITIVITY control setting, the ventilator will activate when the threshold is reached.

(2) If the patient's inspriatory pressure has exceeded the ASSIST/SIMV SENSITIVITY control setting, the ventilator will wait until the next spontaneous inspiration to reach the activating threshold.

NOTE

Augmented ventilations are continuously monitored. Should apnea occur during ASSIST or SIMV modes of operation, the control module microprocessor will invoke a special assist mode. (Refer to para 2-17b or para 2-18b.)

2-17. ASSIST MODE of operation (fig 2-11).

a. In ASSIST MODE, the ventilator is used to establish a controlled breathing rate, inspiration time, and gas flow just like in the CTRL MODE. In addition, if the patient initiates a breath, the ventilator will synchronously deliver a positive pressure breath at the same FLOW ADJUST and INSPIRATION TIME settings as the ASSIST MODE settings. If the patient's spontaneous rate falls below the ventilator settings, it will work as if it were set to the CTRL MODE.

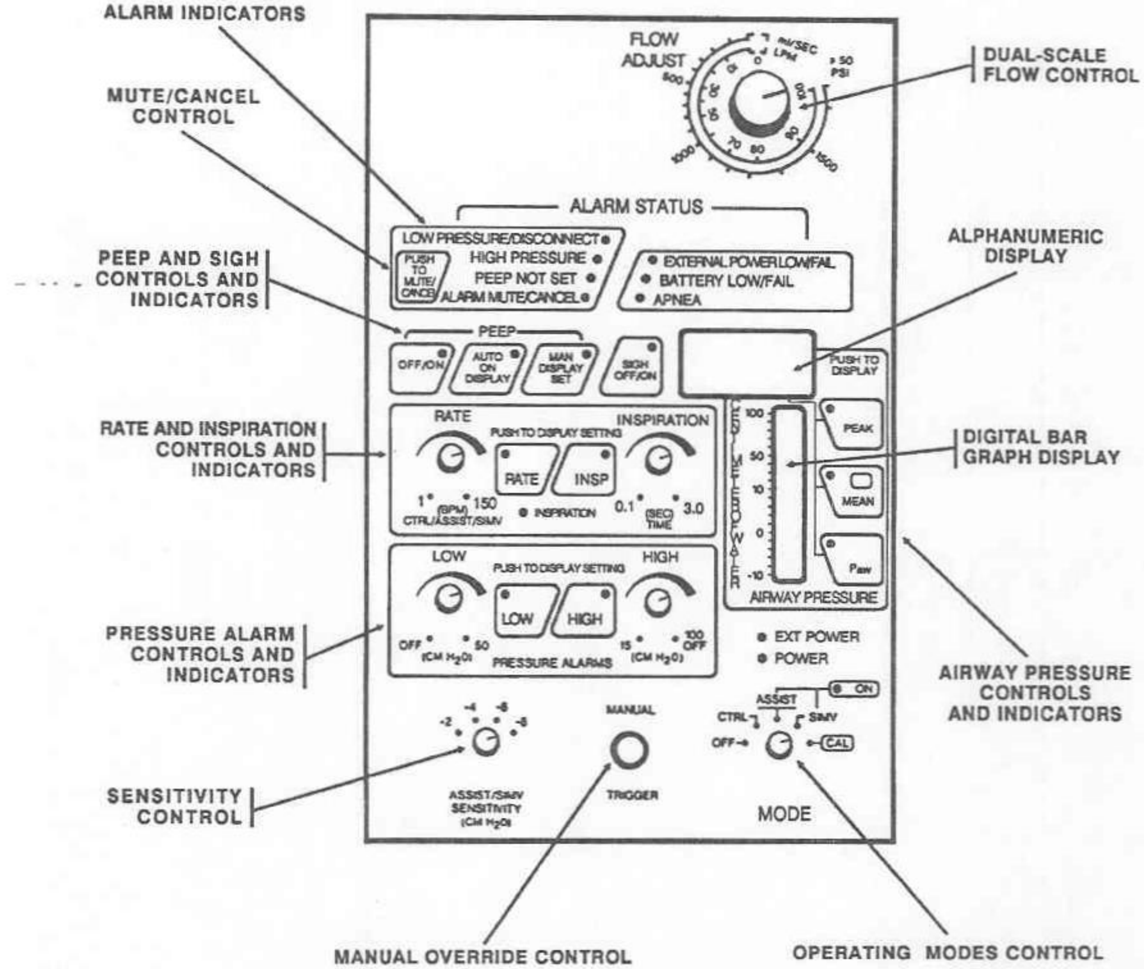

ALARM INDICATORS
MUTE/CANCEL CONTROL
PEEP AND SIGH CONTROLS AND INDICATORS
RATE AND INSPIRATION CONTROLS AND INDICATORS
PRESSURE ALARM CONTROLS AND INDICATORS
SENSITIVITY CONTROL
MANUAL OVERRIDE CONTROL
OPERATING MODES CONTROL
DUAL-SCALE FLOW CONTROL
ALPHANUMERIC DISPLAY
DIGITAL BAR GRAPH DISPLAY
AIRWAY PRESSURE CONTROLS AND INDICATORS
FLOW ADJUST
ml/SEC
LPM
≥ 50 PSI
ALARM STATUS
LOW PRESSURE/DISCONNECT
PUSH TO MUTE/CANCEL
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
OFF/ON
AUTO ON DISPLAY
MAN DISPLAY SET
SIGH OFF/ON
PUSH TO DISPLAY
RATE
INSPIRATION
PUSH TO DISPLAY SETTING
RATE
INSP
1 (BPM) 150
CTRL/ASSIST/SIMV
INSPIRATION
0.1 (SEC) 3.0 TIME
PEAK
MEAN
Paw
CM H2O
AIRWAY PRESSURE
LOW
HIGH
PUSH TO DISPLAY SETTING
LOW
HIGH
OFF 50 (CM H2O)
15 100 OFF (CM H2O)
PRESSURE ALARMS
EXT POWER
POWER
-2 -4 -6 -8
ASSIST/SIMV SENSITIVITY (CM H2O)
MANUAL
TRIGGER
ASSIST
ON
CTRL
SIMV
OFF
CAL
MODE

Figure 2-11. ASSIST MODE.

b. If the patient becomes apneic, the ventilator will activate the APNEA ALARM and automatically invoke special assist ventilations at its FLOW ADJUST and INSPIRATION TIME settings or 12 ventilations per minute, whichever is greater.

c. Gas flow may consist of 100 percent medical-grade oxygen, medical-grade air, or a blended combination of the two gases. Additionally, operation in this mode may be with or without SIGH and with LOW or HIGH PRESSURE ALARM settings as well.

d. Establish ASSIST MODE by completing the following actions:

(1) Turn the MODE selector switch to the ASSIST position.

NOTE

Do not connect the patient valve to the patient until the automatic self-test is completed.

(2) Wait for the self-test to be completed.

(3) Observe that the ventilator automatically begins cycling (upon completion of the self-test).

(4) Observe that the ASSIST/SIMV ON indicator lamp illuminates.

(5) Observe that the INSPIRATION indicator lamp illuminates during the inspiratory portion of each assisted or controlled ventilation.

NOTE

When the ASSIST MODE cycling operation begins, the LOW PRESSURE/DISCONNECT audible alarm and lamp will activate and remain on until the patient valve is connected to a patient and the transducer detects a pressure rise during the next ventilator-generated breath, or the PUSH TO MUTE/CANCAL membrane switch is depressed.

(6) Adjust the FLOW ADJUST control as required.

(7) Adjust the RATE control setting as required.

(8) Adjust the INSPIRATION TIME control setting as required.

NOTE

Tidal volume can be quickly calculated by multiplying the FLOW ADJUST control setting (using the mL/sec scale) by the INSPIRATION TIME control setting in seconds or fractions of seconds. Refer to figure 1-9 or the decal affixed to the back of the control module for a tidal volume computation chart.

(9) Adjust the LOW PRESSURE ALARM setting, if required. Otherwise turn it to the OFF position.

NOTE

The disconnect portion of the LOW PRESSURE/DISCONNECT alarm capability will continue to function when the LOW PRESSURE ALARM is set to OFF.

(10) Adjust the HIGH PRESSURE ALARM setting, if required. Otherwise turn it to the OFF position.

NOTE

When the HIGH PRESSURE ALARM is set to OFF, a 100-cm H_2O peak inspiratory pressure relief default remains active.

(11) Adjust the ASSIST/SIMV SENSITIVITY control setting to select the activation point of each assisted breath relative to the patient's inspiratory effort.

(12) Connect the patient's face mask, endotracheal tube, or tracheostomy tube to the patient valve.

(13) Observe that the patient's spontaneous breathing activates the ventilator. If not, readjust the ASSIST/SIMV SENSITIVITY control setting for greater activation sensitivity (less negative pressure deflection).

(14) Attach the optional PEEP valve and adjust it to the required settings.

(15) Depress the PEEP OFF/ON membrane switch.

NOTE

Excessive flows and/or inspiration times, occlusion of the patient circuit, or a change in the patient's physiological condition can cause a rise in inspiratory pressure. To safeguard the patient from high inspiratory pressures, the ventilator uses a protective peak inspiratory pressure relief system. Selection of a peak inspiratory pressure relief value corresponds to the HIGH PRESSURE ALARM control setting. When the HIGH PRESSURE ALARM control is set to OFF, a default of 100 cm H_2O is invoked. Airway pressures in excess of the peak setting are automatically vented to the atmosphere.

(16) Depress the SIGH OFF/ON membrane switch, if required.

NOTE

A SIGH ventilation is initiated and then repeated once every 100 ventilations or 7 minutes, whichever occurs first. Each SIGH ventilation equals 150 percent of the INSPIRATION TIME control setting. However, as a safety precaution, the ventilator will automatically truncate SIGH to a combined maximum of 3 seconds.

2-18. SIMV MODE of operation (fig 2-12).

a. In SIMV MODE, the ventilator permits a patient to breathe unassisted while periodically receiving mandatory breaths from the ventilator. The ventilator is programmed to deliver mandatory breaths as determined by the FLOW ADJUST, RATE, INSPIRATION TIME, and ASSIST/SIMV SENSITIVITY control settings. Depending upon the application, spontaneous breathing gas may originate from ambient (room) air, an external gas source, or from an optional demand valve mechanism which senses, by negative pressure deflections, the patient's spontaneous effort. The pull of ambient air is through the antiasphxiation port on the patient valve. Gas from a continuously flowing source should be connected to the demand valve port on the patient valve. Mandatory breaths generated by the ventilator are controlled ventilations synchronized with the patient's spontaneous effort. When it is time to deliver a mandatory breath, the ventilator allows a period of time so that it can synchronize with the patient's next breath. If there is no inspiratory effort during the timing period, the mandatory breath will be delivered at the end of the period regardless of the patient's effort.

b. If the patient becomes apneic, the ventilator will activate the APNEA ALARM and automatically invoke special assist ventilations at the FLOW ADJUST and INSPIRATION TIME settings or 12 ventilations per minute, whichever is greater.

c. Gas flow may consist of 100 percent medical-grade oxygen, medical-grade air, or a blended combination of the two gases. Additionally, operation in this mode may be with or without SIGH and pressure alarms.

d. Establish SIMV MODE by completing the following actions:

(1) Turn the MODE selector switch to the SIMV position.

NOTE

Do not connect the patient valve to the patient until the automatic self-test is completed.

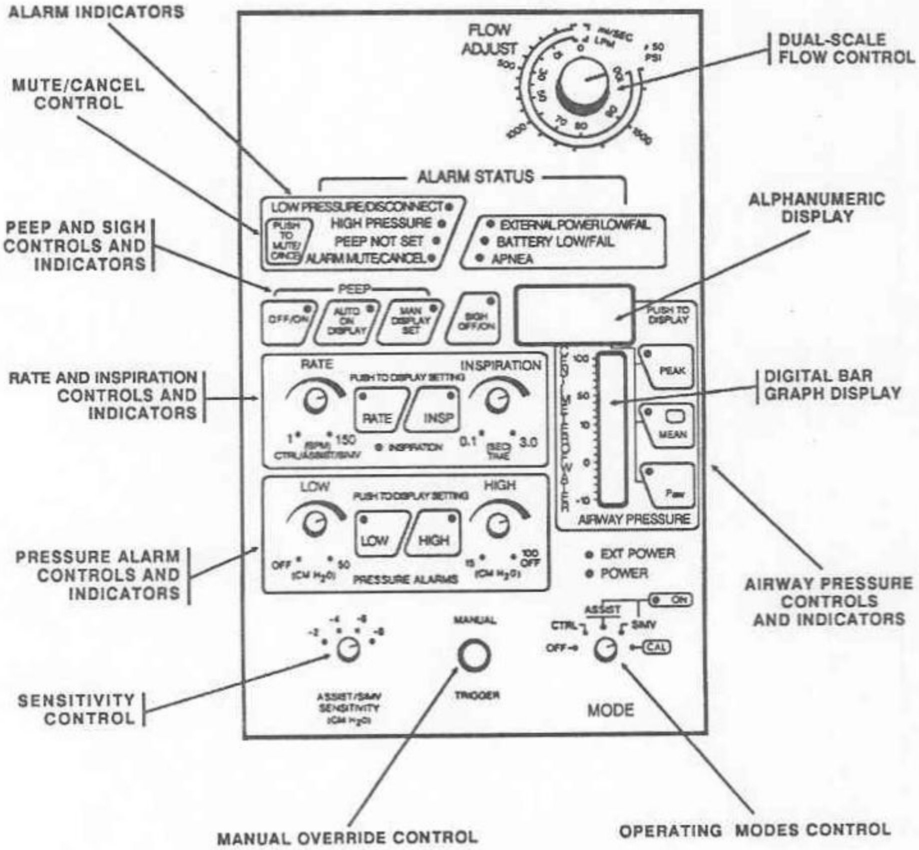

ALARM INDICATORS
MUTE/CANCEL CONTROL
PEEP AND SIGH CONTROLS AND INDICATORS
RATE AND INSPIRATION CONTROLS AND INDICATORS
PRESSURE ALARM CONTROLS AND INDICATORS
SENSITIVITY CONTROL
DUAL-SCALE FLOW CONTROL
ALPHANUMERIC DISPLAY
DIGITAL BAR GRAPH DISPLAY
AIRWAY PRESSURE CONTROLS AND INDICATORS
MANUAL OVERRIDE CONTROL
OPERATING MODES CONTROL
FLOW ADJUST
LPM
50 PSI
ALARM STATUS
LOW PRESSURE/DISCONNECT
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
PUSH TO MUTE/CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
OFF/ON
AUTO ON DISPLAY
MAN DISPLAY SET
SIGH OFF/ON
PUSH TO DISPLAY
RATE
INSPIRATION
PUSH TO DISPLAY SETTING
RATE
INSP
1
150
(BPM)
CTRL/ASSIST/SIMV
INSPIRATION
0.1
3.0
(SEC) TIME
PEAK
MEAN
Paw
100
50
10
0
-10
AIRWAY PRESSURE
LOW
HIGH
PUSH TO DISPLAY SETTING
LOW
HIGH
OFF
50
(CM H2O)
PRESSURE ALARMS
15
100 OFF
(CM H2O)
EXT POWER
POWER
-2
-4
-6
-8
ASSIST/SIMV SENSITIVITY (CM H2O)
MANUAL
TRIGGER
ON
ASSIST
CTRL
SIMV
OFF
CAL
MODE

Figure 2-12. SIMV MODE.

(2) Wait for the self-test to be completed.

(3) Observe that the ventilator automatically begins cycling (upon completion of the self-test).

(4) Observe that the ASSIST/SIMV ON indicator lamp illuminates.

(5) Observe that the INSPIRATION indicator lamp illuminates during the inspiratory portion of each assisted or controlled ventilation.

NOTE

When the SIMV MODE cycling operation begins, the LOW PRESSURE/DISCONNECT audible alarm and lamp will activate and remain on until the patient valve is connected to a patient and the transducer detects a pressure rise during the next ventilator-generated breath, or until the PUSH TO MUTE/CANCEL membrane switch is depressed.

(6) Adjust the FLOW ADJUST control as required.

(7) Adjust the RATE control setting as required.

(8) Adjust the INSPIRATION TIME control setting as required.

NOTE

Tidal volume can be quickly calculated by multiplying the FLOW ADJUST control setting (using the mL/sec scale) by the INSPIRATION TIME control setting in seconds or fractions of seconds. Refer to figure 1-9 or the decal affixed to the back of the control module for a tidal volume computation chart.

(9) Adjust the LOW PRESSURE ALARM setting, if required. Otherwise turn it to the OFF position.

NOTE

The disconnect portion of the LOW PRESSURE/DISCONNECT alarm capability will continue to function when the LOW PRESSURE ALARM is set to OFF.

(10) Adjust the HIGH PRESSURE ALARM setting, if required. Otherwise turn it to the OFF position.

NOTE

When the HIGH PRESSURE ALARM is set to OFF, a 100-cm H_2O peak inspiratory pressure relief default remains active.

(11) Adjust the ASSIST/SIMV SENSTIVITY control setting to select the activation point of each assisted breath relative to the patient's inspiratory effort.

(12) Connect the patient's face mask, endotracheal tube, or tracheostomy tube to the patient valve.

(13) Observe that the patient's spontaneous breathing activates the ventilator. If not, readjust the ASSIST/SIMV SENSITIVITY control setting for greater activation sensitivity (less negative pressure deflection).

(14) Attach the optional PEEP valve and adjust it to the required settings.

(15) Depress the PEEP OFF/ON membrane switch.

NOTE

Excessive flows and/or inspiration times, occlusion of the patient circuit, or a change in the patient's physiological condition can cause a rise in inspiratory pressure. To safeguard the patient from high inspiratory pressures, the ventilator uses a protective peak inspiratory pressure relief system. Selection of a peak inspiratory pressure relief value corresponds to the HIGH PRESSURE ALARM control setting. When the HIGH PRESSURE ALARM control is set to OFF, a default of 100 cm H_2O is invoked. Airway pressure in excess of the peak setting is automatically vented to the atmosphere.

(16) Depress the SIGH OFF/ON membrane switch, if required.

NOTE

A SIGH ventilation is initiated and then repeated once every 100 ventilations or 7 minutes, whichever occurs first. Each SIGH ventilation equals 150 percent of the INSPIRATION TIME control setting. However, as a safety precaution, the ventilator will automatically truncate SIGH to a combined maximum of 3 seconds.

Section VII. AUGMENTED VENTILATION

2-19. Demand valve operation.

a. An optional demand valve is functional only in the SIMV MODE of operation.

b. During SIMV operation, the microprocessor is programmed to differentiate between spontaneous breaths and mandatory ventilations (synchronized or nonsynchronized). A pressure deflection, less than 1 cm H_2O below end pressure, is required to activate the demand valve solenoid. When a spontaneous patient effort is detected, the demand valve initiates a continuous flow of gas into the patient valve. This demand flow is approximately 60 lpm which creates a slight pressure support in the patient circuit. The level of pressure support will vary inversely relative to the patient's inspiratory effort. Demand flow will end when expiratory pressure exceeds the pressure support by approximately 3 cm H_2O or following 3 seconds of continuous flow, whichever occurs first. During the inspiratory demand period, the patient valve exhalation port remains open. Demand valve operation is automatically referenced to PEEP.

CAUTION

Pediatric demand flow requirements should be considered before using the demand valve.

2-20. Continuous positive airway pressure (CPAP).

The ventilator control module RATE control cannot be set to 0; therefore, traditional CPAP is not possible. However, potential benefits are possible by operating the ventilator in the SIMV MODE with a RATE setting of 1 and PEEP set to ON.

2-21. ASSIST/SIMV MODE ventilation during apnea.

a. As a safety precaution during apnea, the microprocessor automatically switches from ASSIST/SIMV MODE to a special assist/control default mode and simultaneously activates the APNEA ALARM. This occurs when the period between positive and/or negative pressure deflections exceeds 19 seconds minus the INSPIRATION TIME setting (18.9 to 16.0 seconds).

b. The ventilator defaults to 12 ventilations per minute and the current FLOW ADJUST and INSPIRATION TIME control settings.

NOTE

During the APNEA ALARM, it is possible to adjust the RATE setting to a rate greater than the default rate. However, if the RATE setting is adjusted to less than the default rate, the default rate will prevail.

c. Depress the PUSH TO MUTE/CANCEL membrane switch to do the following:

(1) Cancel the apnea alarm.

(2) Stop the special assist/control default mode.

(3) Start the normal ASSIST/SIMV MODE.

2-22. Positive end expiratory pressure.

CAUTION

PEEP controls should not be activated unless an external PEEP valve is connected to the patient valve.

NOTE

The ventilator uses a "single-hose" patient circuit. All inspiratory and expiratory valving is done in the patient valve. Since exhaled gas is not routed through the control module, PEEP information from waveform monitoring is acquired either through the transducer or from direct programming.

a. The PEEP function provides a means of converting the transducer calibration pressure reference from atmospheric pressure to atmospheric pressure plus PEEP pressure. The PEEP function operates in two primary modes: automatic and manual.

(1) *Automatic mode.* In this mode, the microprocessor analyzes the expiratory pressure waveform to determine the set PEEP reference value. Analysis consists of averaging three consecutive exhalations from the time the PEEP OFF/ON membrane switch is depressed. This value can be displayed and verified in the alphanumeric display by depressing the PEEP AUTO ON/DISPLAY membrane switch. The microprocessor continuously monitors expiratory signals looking for changes in the PEEP value. When the monitored PEEP value exceeds the reference PEEP value by more than ± 2 cm H_2O for three consecutive breaths, the PEEP NOT SET ALARM will activate.

(2) *Manual mode.* In this mode, a PEEP reference value is manually entered into the microprocessor using the PEEP MAN DISPLAY/SET membrane switch. In this mode, the microprocessor does not monitor PEEP and the PEEP NOT SET ALARM becomes inactive.

b. PEEP functions are controlled by the following control switches:

(1) *PEEP OFF/ON membrane switch.* In the OFF setting, PEEP functions are disabled and the PEEP valve should either be removed from the patient valve or the PEEP valve set to 0, if adjustable. In the ON setting, automatic PEEP monitoring is activated and the PEEP OFF/ON indicator lamp illuminates.

NOTE

When the PEEP OFF/ON membrane switch is depressed, the microprocessor begins to average three exhalation wave forms to determine the PEEP reference value. During this averaging period, the PEEP NOT SET ALARM will blink (the audible alarm is not activated) and a bar will revolve within the alphanumeric display. When averaging is complete, the PEEP reference value is shown in the alphanumeric display for 3 seconds and the blinking PEEP NOT SET ALARM lamp blanks.

(2) *PEEP AUTO ON/DISPLAY membrane switch.* The PEEP AUTO ON function is automatically activated when the PEEP OFF/ON membrane switch is set to ON. This permits automatic monitoring of PEEP and illuminates the PEEP AUTO ON/DISPLAY indicator lamp. Depressing this switch will either initiate a mode change from PEEP manual to PEEP automatic or display the reference PEEP value in the alphanumeric display.

(3) *PEEP MAN DISPLAY/SET membrane switch.* Depressing this switch illuminates the PEEP MAN DISPLAY/SET indicator lamp and either displays the PEEP manual setting in the alphanumeric display or allows a PEEP manual value to be entered and viewed in the alphanumeric display. To set a value of PEEP, depress and hold down the PEEP MAN DISPLAY/SET membrane switch for more than 3 seconds. This will cause a change from DISPLAY mode to SET mode and initiate scrolling within the alphanumeric display. The displayed value will increase from the current PEEP value up to "20" cm H_2O, return to "0," and then scroll upwards again. When the membrane switch is released, the alphanumeric displays registers the set manual PEEP value. While the alphanumeric display is operating, the manual PEEP value can be increased, in 1-cm H_2O increments, each time the PEEP MAN DISPLAY/SET membrane switch is depressed.

Section VIII. ALARM FUNCTIONS

2-23. General.

a. The ventilator contains numerous alarm circuits, designed to alert attending personnel and protect the patient. Alarm conditions, depending upon type, may be temporarily muted or cancelled. Mutable alarms will reset automatically when the alarm condition is no longer valid.

b. The PUSH TO MUTE/CANCEL membrane switch deactivates the audible portion of an existing alarm for a predetermined period (with the exception of certain power alarm conditions). Mute periods for EXTERNAL POWER LOW/FAIL or BATTERY LOW/FAIL ALARMS normally last for 5 minutes. If an EXTERNAL POWER LOW/FAIL ALARM occurs and is muted, the mute period will last until the internal battery is depleted. At this point, a BATTERY LOW/FAIL ALARM activates in addition to the EXTERNAL POWER LOW/FAIL ALARM, and muting will now last for a 5-minute period. Conversely, a BATTERY LOW/FAIL ALARM will remain continuously muted if an external source of electrical power is connected to the ventilator. LOW PRESSURE/DISCONNECT, HIGH PRESSURE, and PEEP NOT SET alarms last for 30 seconds. In all instances, a new alarm condition will override a preexisting mute.

2-24. Description of alarms (fig 2-13).

a. EXTERNAL POWER LOW/FAIL ALARM. This alarm activates when the ventilator senses an external electrical power source disruption or failure.

b. BATTERY LOW/FAIL ALARM. This alarm activates when the internal battery of the ventilator falls below 11 VDC, or a shorted battery is detected.

c. APNEA ALARM. The apnea alarm is functional in the ASSIST and SIMV modes. It activates when the period between positive and/or negative pressure deflections exceeds 19 seconds minus the INSPIRATION TIME setting (18.9 to 16.0 seconds).

NOTE

> When PEEP is activated, the ventilator will only consider positive pressure deflections. If the alarm activates, the ventilator will invoke its special assist mode of operation. The APNEA ALARM can be cancelled by depressing the PUSH TO MUTE/CANCEL membrane switch but the alarm cannot be muted.

d. LOW PRESSURE/DISCONNECT ALARM. This alarm activates when the patient's airway pressure falls below the LOW PRESSURE ALARM control setting for two consecutive inspiratory cycles. A disconnect in the patient's circuit will also activate this alarm. However, the activation criteria is not the same for all modes of operation.

(1) *CTRL and ASSIST modes*. In these modes, the microprocessor checks for a positive pressure rise of at least 1 cm H_2O to occur within 150 percent of the INSPIRATION TIME control setting. If the required positive pressure rise does not occur within this period, the LOW PRESSURE/DISCONNECT ALARM activates.

(2) *SIMV MODE*. For ventilator rates greater than 3 ventilations per minute, the LOW PRESSURE/DISCONNECT ALARM functions as if the CTRL MODE or ASSIST MODE were set. For ventilator rates less than 3 ventilations per minute, the microprocessor alarm activates when respirations are not detected for a period of 19 seconds minus the INSPIRATION TIME control setting (18.9 to 16.0 seconds). To qualify the alarm condition as disconnect or apnea, the microprocessor automatically delivers a controlled ventilation at the INSPIRATION TIME control setting. If a pressure rise of at least 1 cm H_2O occurs within 150 percent of the INSPIRATION TIME setting, the APNEA ALARM is activated. If a pressure rise is not detected, the microprocessor returns to SIMV MODE and activates its LOW PRESSURE/DISCONNECT ALARM, repeating it every 30 seconds.

e. HIGH PRESSURE ALARM. This alarm activates when the patient's airway pressure exceeds the HIGH PRESSURE ALARM control setting for a continuous 2 seconds or 50 milliseconds for four consecutive ventilations. When the HIGH PRESSURE ALARM control is set to OFF, a safety default of approximately 100 cm H_2O remains.

(1) The HIGH PRESSURE ALARM setting is also the safety setting for peak inspiratory pressure relief. Excessive flow rates and/or inspiration times, occlusion of the patient circuit, or a change in the patient's

physiological condition can cause a rise in inspiratory pressure. To safeguard the patient from high inspiratory pressures, the ventilator compares the peak inspiratory pressure against the HIGH PRESSURE ALARM setting.

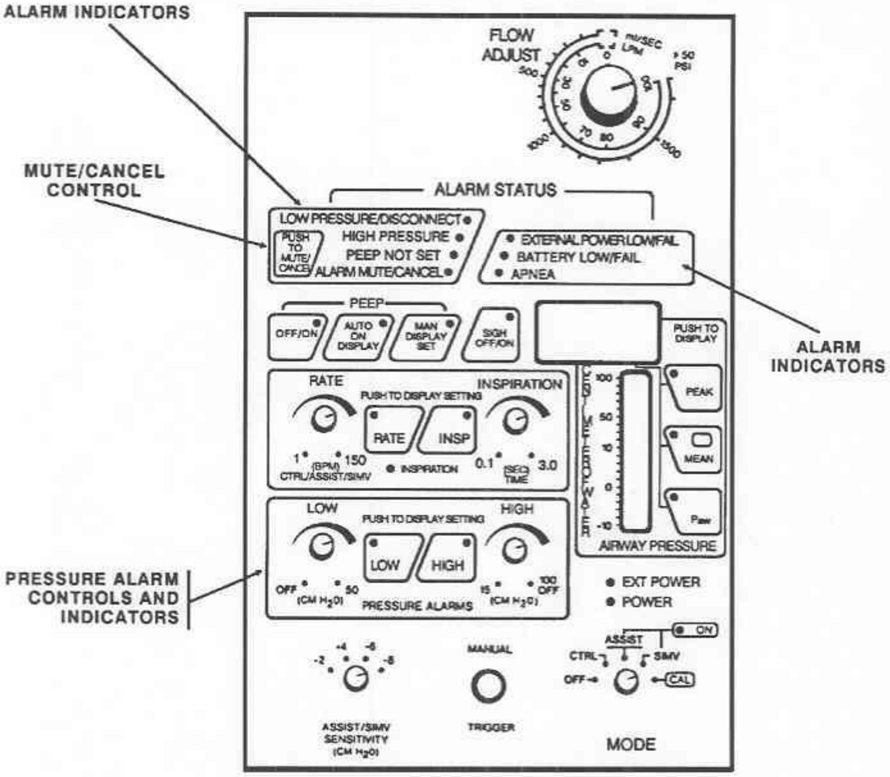

ALARM INDICATORS
MUTE/CANCEL CONTROL
PRESSURE ALARM CONTROLS AND INDICATORS
ALARM INDICATORS
FLOW ADJUST
ALARM STATUS
LOW PRESSURE/DISCONNECT
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
PUSH TO MUTE/CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
OFF/ON
AUTO ON DISPLAY
MAN DISPLAY SET
SIGH OFF/ON
PUSH TO DISPLAY
RATE
INSPIRATION
PUSH TO DISPLAY SETTING
RATE
INSP
CTRL/ASSIST/SIMV
INSPIRATION TIME
PEAK
MEAN
AIRWAY PRESSURE
LOW
HIGH
PRESSURE ALARMS
EXT POWER
POWER
ASSIST
CTRL
SIMV
ON
OFF
CAL
MANUAL
TRIGGER
ASSIST/SIMV SENSITIVITY (CM H2O)
MODE

Figure 2-13. Alarms.

(2) When a high inspiratory pressure condition occurs and exceeds the HIGH PRESSURE ALARM control setting by 5 cm H_2O, the ventilator interrupts the flow of gas to the patient circuit. This allows excess pressure to vent through the patient valve's exhaust port to the atmosphere, while allowing the inspiration time cycle to continue. When the patient circuit pressure falls below the activation point (3 cm H_2O below the HIGH PRESSURE ALARM control setting), gas flow is allowed to resume for the remainder of the inspiratory cycle. If the HIGH PRESSURE ALARM control is set to OFF, a peak inspiratory pressure relief default of approximately 100 cm H_2O remains.

f. PEEP NOT SET ALARM. This alarm activates when monitored PEEP exceeds the PEEP reference value by ± 2 cm H_2O for three consecutive respiratory cycles.

NOTE

If a LOW PRESSURE/DISCONNECT ALARM occurs during normal operation and is responsible for causing a PEEP NOT SET ALARM, the ventilator will restore the PEEP AUTO ON/DISPLAY mode to its pre-disconnect reference value when the causative disconnect problem is corrected.

g. Inverse I:E alarm. This alarm is activated when the INSPIRATION TIME control is set for a period which is longer than the expiratory time. When inverse I:E occurs, the RATE and INSP lamps alternately flash, a pulsing tone sounds, and the alphanumeric display shows "-IE." Inverse I:E alarms are not mutable and must be corrected before further operation is permitted. Until corrected, the ventilator defaults to an antiasphyxiation condition.

NOTE

The inverse I:E condition can be corrected by lowering the RATE control setting, the INSPIRATION TIME control setting, or both settings.

h. Memory check alarm. This alarm activates when the memory check portion of the self-test fails. A beeping tone is activated and the alphanumeric display continuously shows "FAL." This alarm cannot be muted or cancelled.

i. Transducer calibration alarm. The transducer alarm activates when the transducer zero baseline exceeds ± 1 cm H_2O. When activated, an audible tone begins and the alphanumeric display alternately flashes "---" and the current transducer calibration value. The alarm resets itself after calibration of the transducer is completed.

j. Transducer calibration abort alarm. This alarm activates when the transducer calibration procedures are prematurely stopped. When activated, a steady tone is emitted and the alphanumeric display alternately flashes "---" and the current transducer calibration value. The alarm resets itself after calibration of the transducer is completed.

k. "FAL" alarm. The "FAL" alarm activates when a random access memory or read only memory failure occurs during operation in the CTRL, ASSIST, or SIMV modes. It also activates if a continuous pressure above 95 cm H_2O is sensed in the patient circuit for more than 0.5 seconds. When activated, a beeping tone is emitted and "FAL" shows in the alphanumeric display. A "FAL" alarm will cause the ventilator to stop operation when gas is not flowing, allowing the patient circuit pressure to vent to the atmosphere. The MODE switch must be turned to the OFF position and then returned to the MODE operating position to clear a "FAL" condition. During a "FAL" condition, the patient can spontaneously breathe through the antiasphyxiation port of the patient valve.

Section IX. VENTILATOR OPERATION

2-25. Start-up procedures.

CAUTION

Do not operate the ventilator unless the temperature is between -60°C (-76°F) and 60°C (140°F) to prevent a critical malfunction or damage to the ventilator.

Start-up procedures are as follows:

a. Review all previous information and instructions in this chapter.

b. Make all connections, interconnections (sec III and IV of this chapter), and initial adjustments between the control module, multivoltage power supply, optional accessories (blender, humidifer, demand valve, PEEP valve, etc.), and patient valve except for connection to the patient interface port.

c. Complete the initial set up, self-test, and transducer calibration (sec V of this chapter).

d. Select the required mode of operation and follow the procedures in section VI of this chapter.

e. Adjust the control settings as required for patient support.

f. Monitor and respond to alarms.

2-26. Shut-down procedures.

Shut-down procedures are as follows:

a. Remove the patient connection to the patient interface port.

b. Turn the MODE switch to the OFF position.

c. Disconnect the patient valve.

d. Turn off the source(s) of gases.

e. Prepare the ventilator either for the next patient or for temporary storage.

Section X. OPERATION OF AUXILIARY EQUIPMENT

2-27. Associated support items of equipment.

a. The ventilator requires an external source of air and oxygen which may include individual gas cylinders (with regulators), centralized piped gas systems for shared use with other medical equipment, or air compressors used to support one or more ventilators. Medical-grade air, medical-grade oxygen, or a blended mixture of the two gases are normally required.

NOTE

A centralized, piped-oxygen system is currently being tested for use in the field environment.

b. The Compressor-Dehydrator, NSN 6520-00-139-1246, TM 8-6520-003-24&P, is currently authorized to support ventilator operation.

2-28. Associated materiel

Associated materiel is identified in appendix F.

Section XI. CLEANING PROCEDURES

2-29. General.

a. The ventilator and operating accessories should be clean at all times. Exposed components should be dried following use in a wet environment. Cleaning at regular intervals is encouraged.

b. Some accessories such as the disposable hoses for interconnecting the control module and the patient valve as well as disposable PEEP valves should not be cleaned and reused. These accessories were manufactured to be used on only one patient.

2-30. Control module.

Wipe the control module daily with a damp, soapy cloth and then dry it with a lint-free cloth.

NOTE

Do not clean the control module with abrasives or chlorinated hydrocarbon cleaners.

2-31. Patient valve (fig 2-14).

a. Disconnect the patient valve from all connecting hoses.

b. Remove the threaded collar which fastens the exhaust port to the main body of the patient valve and then remove the exhaust port.

c. Remove the gas inlet elbow.

d. Remove the two leaf valves (leaf valve #1 and leaf valve #2) from the patient valve body using small forceps or tweezers.

CAUTION

Use light pressure when removing the leaf valves. They damage easily.

e. Remove the flat leaf valve (leaf valve #3) from the exhaust port using small forceps or tweezers.

f. Unscrew the diaphragm valve from the exhaust port fitting and remove the diaphragm.

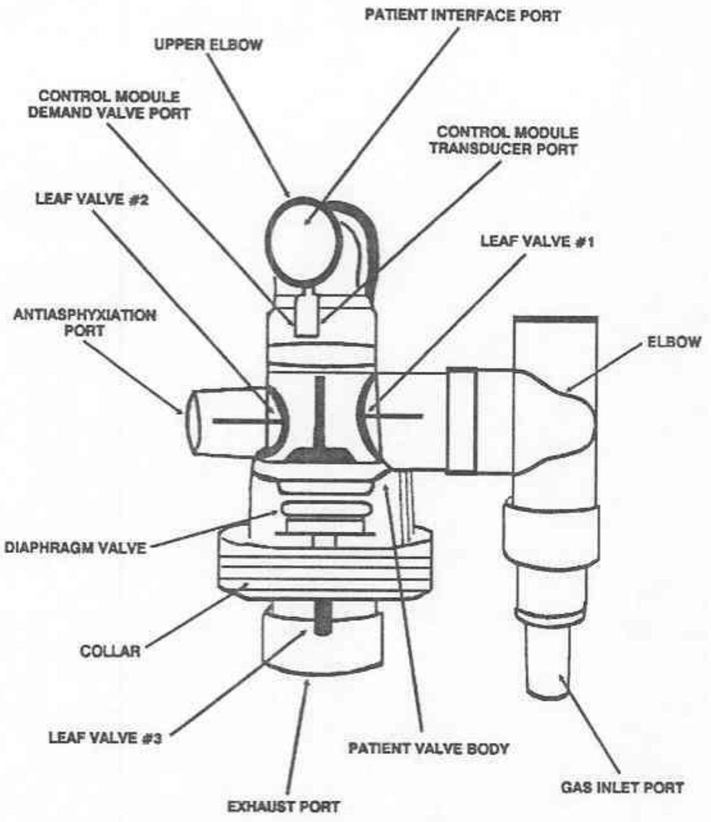

PATIENT INTERFACE PORT
UPPER ELBOW
CONTROL MODULE DEMAND VALVE PORT
CONTROL MODULE TRANSDUCER PORT
LEAF VALVE #2
LEAF VALVE #1
ANTIASPHYXIATION PORT
ELBOW
DIAPHRAGM VALVE
COLLAR
LEAF VALVE #3
PATIENT VALVE BODY
GAS INLET PORT
EXHAUST PORT

Figure 2-14. Patient valve components.

g. Examine the diaphragm and leaf valves for signs of wear, cracks, or stiffness. Replace as required.

h. Wash the components in warm, soapy water.

i. Reassemble all components.

CAUTION

Leaf valves must be pulled until they seat into position. Two leaf valves have stems which can be grabbed with small forceps or tweezers. The flat leaf valve must be seated flush against its seat surface.

j. Sterilize the patient valve using steam or ethylene oxide gas.

k. Store the patient valve for future use.

2-32. Reusable hoses.

a. Disconnect reusable hoses from the patient valve and the connector panel of the control module.

b. Wash the hoses in warm, soapy water.

c. Sterilize the hoses using steam or ethylene oxide gas.

NOTE

DO NOT ATTEMPT TO CLEAN OR STERILIZE DISPOSABLE HOSES. THEY SHOULD NEVER BE REUSED.

2-33. Reusable PEEP valve.

The PEEP valve should be cleaned in accordance with requirements and procedures of the applicable manufacturer.

NOTE

Disposable PEEP valves should NEVER be reused.

Section XII. OPERATION UNDER UNUSUAL CONDITIONS

2-34. General.

No special procedures are required for operation of the ventilator in any environment. The operating temperature range is -60°C (-76°F) to 60°C (140°F).

2-35. Operating time.

The operating time of 9 hours, using the internal batteries as the source of electrical power, may be reduced as the environmental temperature decreases.

CHAPTER 3

BLENDER

Section I. GENERAL INFORMATION

3-1. Scope.

a. An air/oxygen blender (fig 3-1) is provided for use with the ventilator as an additional authorization list item (app F).

b. This chapter contains all pertinent information and instructions for the blender.

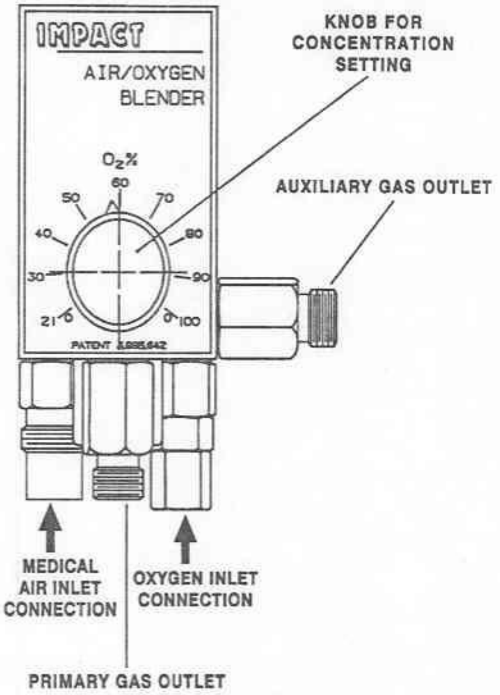

IMPACT
AIR/OXYGEN BLENDER
O2%
60
50
70
40
80
30
90
21
100
PATENT
KNOB FOR CONCENTRATION SETTING
AUXILIARY GAS OUTLET
MEDICAL AIR INLET CONNECTION
OXYGEN INLET CONNECTION
PRIMARY GAS OUTLET

Figure 3-1. Blender.

Section II. EQUIPMENT DESCRIPTION AND DATA

3-2. Overview of operation (fig 3-2).

The compact, lightweight blender provides precise oxygen concentrations by means of a single control. It mixes medical-grade air and oxygen to provide a pressurized gas source ranging from 21 to 100 percent oxygen. The two 50-psi gas sources enter the blender through the DISS air and oxygen inlet connectors located on the bottom of the blender. Each inlet connector incorporates a 30-micron particulate filter. From the filter, the gases travel through a duckbill check valve which prevents reverse gas flow from either the air or oxygen supply systems.

a. Balance module. The two gases then enter the balance module which consists of two stages. The purpose of this module is to equalize the operating pressure of the air and oxygen before entering the proportioning module. The diaphragm responds to the difference in pressure and directs the movement (stroke) of each poppet contained within the air and oxygen chambers. The movement of the poppet adjusts the amount of gas flowing through the balance module, equalizing the air and oxygen pressures.

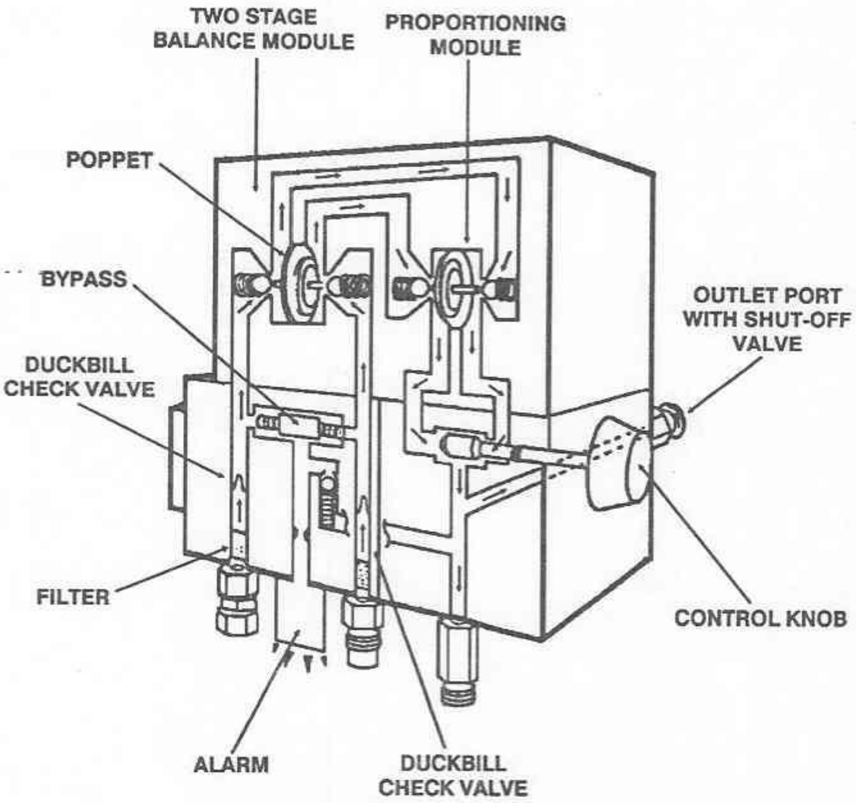


Figure 3-2. Gas flows.

b. Proportioning module. The two gases now flow into the proportioning module and are mixed according to the oxygen percentage selected on the control knob. This module consists of a double-ended valve positioned between two valve seats. One valve seat controls the passage of air and the other valve seat controls the passage of oxygen into the blender outlet. At this point, the two gases have been blended. With the control knob at the full counterclockwise position (21 percent), the double-ended valve will completely close off the flow of oxygen, allowing only the air to flow. By adjusting the control knob to the full clockwise position (100 percent), the flow of air is blocked, allowing only the flow of oxygen through the blender outlet.

c. Alarm. An alarm sounds if source pressures differ by 20 psi or more. The primary purpose of this alarm is to audibly warn the operator of an excessive pressure drop or depletion of either source gas. The alarm will also activate when there is an elevation of either gas source resulting in a 20-psi difference. If both gas pressures increase or decrease simultaneously, and a 20-psi differential is not seen, there will not be an audible alarm.

NOTE

If either source gas pressure drops, the output pressure of the blender will drop similarly, since the source gases are always balanced to the lower pressure.

d. Bypass. The bypass function operates in unison with the alarm. The alarm bypass poppet is directly linked with the air supply on one end and the oxygen supply on the other end. When the two source gases are within 20 psi in pressure, the alarm bypass poppet is positioned over the bypass channel, blocking the flow of both gases. Once a 20-psi difference occurs, the higher gas pressure will overcome the spring force and pressure of the poppet at its opposite end, thus creating a path for gas to flow into the alarm channel. The gas with the higher pressure will also flow directly to the blender outlet port bypassing the balance and proportioning modules. The blender in the alarm/bypass condition will deliver either oxygen (100 percent) or air (21 percent) depending on which gas is at the higher pressure.

NOTE

If the blender control knob is set at 21 percent concentration and the oxygen source pressure is reduced enough to preclude a 20 psi or greater differential, the blender will not alarm because it will continue to deliver a 21 percent concentration according to the setting. The alarm will sound if the control knob is moved slightly over 21 percent. Similarly, if the blender control knob is set at 100 percent concentration and the air source pressure is reduced, the blender will not alarm because it will continue to deliver a 100 percent concentration according to the setting. The blender will not alarm when not in patient use but left connected to source gases and a 20-psi pressure differential develops.

e. Gas outlets.

(1) The primary gas outlet is located on the bottom of the blender. It is used for unmetered high-flow applications in the range of 15 to 120 lpm. The flow of gas is automatically initiated by the attachment of a patient valve to the outlet port. In turn, the outlet port will automatically shut off when the patient valve is disconnected.

(2) The auxiliary outlet, located on the right side of the blender, is designed to deliver metered gas through a flowmeter. Blended gas will be accurately delivered from this outlet at 2 lpm and above. Like the primary gas outlet, the auxiliary gas outlet has an automatic shut-off valve.

CAUTION

The simultaneous use of the primary gas outlet and the auxiliary gas outlet will allow neither outlet to deliver the maximum rated flow. The combined peak flow of both outlets will be 120 lpm.

NOTE

When the auxiliary gas outlet has a flowmeter connected to it, a flow of 10 to 12 lpm bleeds from the bottom of the blender.

3-3. Tabulated data.

The tabulated data provides the physical characteristics and other information about the blender.

a. Physical and miscellaneous characteristics. Tables 3-1 and 3-2 provide a broad range of physical and miscellaneous characteristics.

Table 3-1. Blender physical characteristics.

Weight	1.25 kg (2.75 lbs)
Dimensions	
Length	9.2 cm (3.63 in)
Width	5.8 cm (2.28 in)
Height	8.3 cm (3.27 in)

Table 3-2. Miscellaneous characteristics.

Gas supply pressure	30 to 75 psi
Oxygen concentration control adjustment range	21 to 100 percent
Primary gas outlet flow range	15 to 120 lpm
Auxiliary gas outlet flow range	2 to 90 lpm
Maximum total flow	120 lpm
Bypass flow	90 lpm
Alarm sound generator	Reed alarm
Alarm sound level	80 db @ 1 ft
Alarm bypass reset	Less than 6 psi inlet gas pressure differential
Accuracy (with inlet gases within 10 psi and each gas pressure greater than 30 psi but less than 75 psi)	±1 percent of full scale over the flow range (±3 percentage points at any reading)

b. Identification, instruction, and warning plates, decals, or markings.

(1) Component identification, instructions, and a warning are provided on decals, located on the bottom of the blender, as illustrated in figure 3-3.

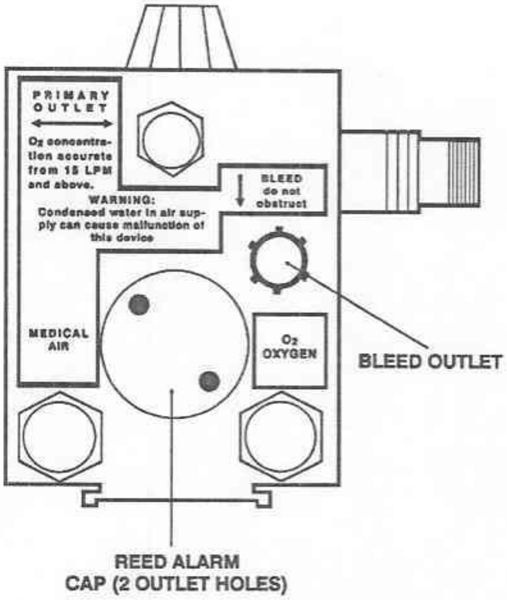

PRIMARY OUTLET
O_2 concentration accurate from 15 LPM and above.
WARNING: Condensed water in air supply can cause malfunction of this device
BLEED do not obstruct
MEDICAL AIR
O_2 OXYGEN
BLEED OUTLET
REED ALARM CAP (2 OUTLET HOLES)

Figure 3-3. Blender decals.

(2) A decal, located on the right side of the blender, is illustrated in figure 3-4.

AUXILIARY OUTLET
O_2 concentration
accurate from 2 LPM
and above.

Figure 3-4. Auxiliary outlet decal.

Section III. BLENDER OPERATION

3-4. Set-up procedures.

a. Oxygen.

(1) Complete the ventilator assembly, interconnections, and initial adjustments in accordance with the procedures in chapter 2, section IV.

CAUTION

Always operate the blender with clean and dry medical-grade gases. Contaminants or moisture can cause defective operation. The air used for medical purposes will meet United States Pharmacopia (USP) compressed air and/or American National Standards Institute (ANSI) Z86.1-1973 grade F. Water vapor content must not exceed a dew point of -15°C (5°F) below the lowest ambient temperature to which the delivery system is exposed. Particulate content will not exceed that which would be found immediately downstream of a 15-micron absolute filter.

(2) Complete the initial set up, self-test, and calibration in accordance with the procedures in chapter 2, section V.

(3) Disconnect the green oxygen high-pressure hose from the GAS IN port on the ventilator control module connector panel.

(4) Install the DISS male nipple adapter (fig 3-5) on the PRIMARY OUTLET of the blender.

(5) Attach the blender and DISS male nipple adapter to the GAS IN port on the ventilator control module connector panel.

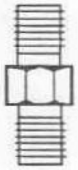


Figure 3-5. Nipple adapter.

CAUTION

Do not occlude or obstruct the bleed outlet on the bottom of the blender and do not tape, obstruct or remove the reed alarm. Such actions may cause malfunctions or endanger the patient.

NOTE

The blender is now physically attached to the top of the control module (fig 3-6).

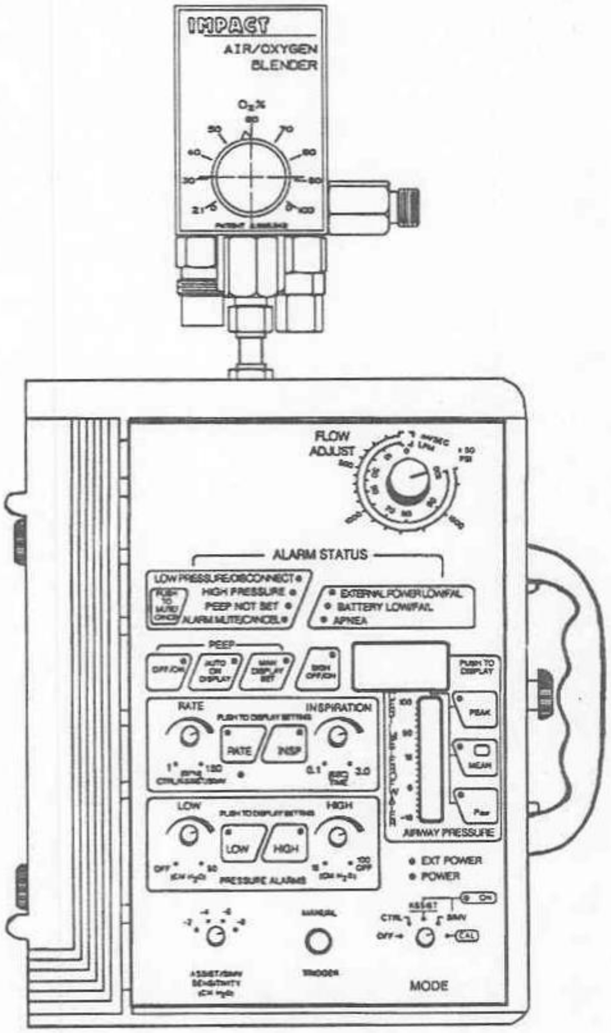

IMPACT
AIR/OXYGEN
BLENDER
O2%
FLOW
ADJUST
ALARM STATUS
LOW PRESSURE/DISCONNECT
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
PUSH TO MUTE/CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
OFF/ON
AUTO ON DISPLAY
MAN DISPLAY SET
SIGH OFF/ON
PUSH TO DISPLAY
RATE
PUSH TO DISPLAY SETTING
INSPIRATION
RATE
INSP
PEAK
MEAN
LOW
HIGH
PRESSURE ALARMS
AIRWAY PRESSURE
EXT POWER
POWER
ASSIST
CTRL
SIMV
ON
OFF
CAL
ASSIST/SIMV SENSITIVITY
TRIGGER
MODE

Figure 3-6. Control module with blender.

(6) Install the DISS swivel nut adapter (fig 3-7) to the blender oxygen connection.

(7) Reconnect the green oxygen high-pressure hose to the adapter installed in the preceding procedure.

b. Air.

(1) Install either connector on the yellow rubber conductive (black striped) hose to the MEDICAL AIR inlet connection on the blender.

(2) Connect the remaining connector, on the yellow rubber conductive hose to the manifold/regulator assembly (fig 3-8).

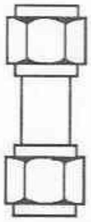


Figure 3-7. DISS swivel nut adapter.

(3) Connect the threaded connector end of the yellow plastic tubing to the manifold/regulator assembly.

(4) Install the quick-disconnect onto the dental compressor air outlet.

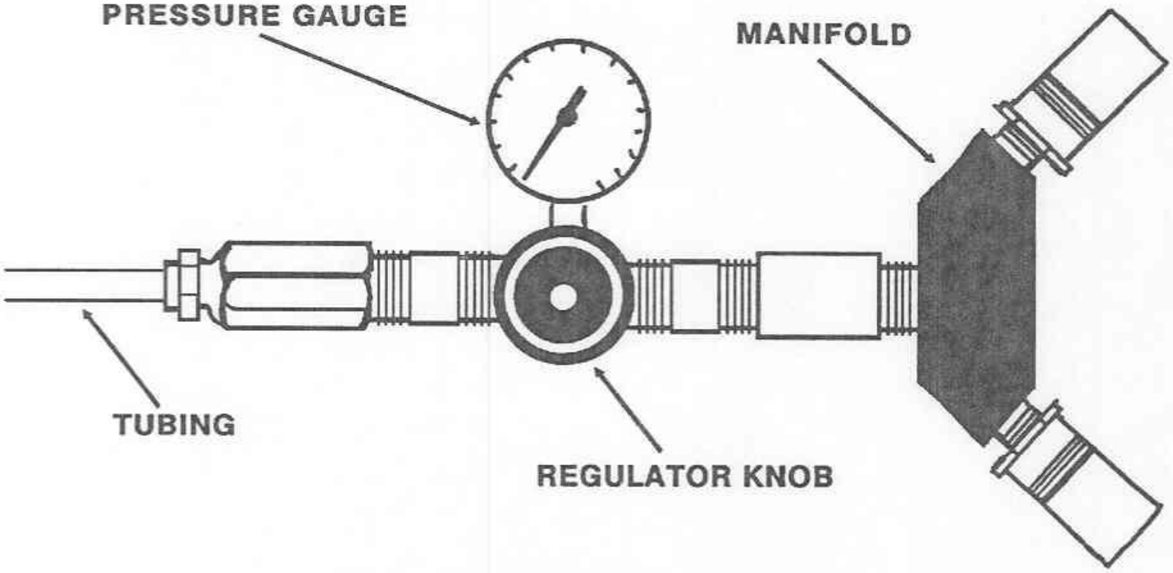


Figure 3-8. Manifold/regulator assembly.

Section IV. OPERATING INSTRUCTIONS

3-5. Flow applications.

a. High flow. The PRIMARY OUTLET, located on the bottom of the blender, serves as the source gas outlet for mechanical ventilators or other pneumatic equipment requiring nonmetered, high pressure air/oxygen mixtures from 15 to 120 lpm. Operation of the blender with high flow applications is as follows:

(1) Ensure that the PRIMARY OUTLET of the blender is connected to the ventilator GAS IN port.

(2) Adjust the concentration control knob to the desired oxygen concentration.

(3) Turn on both air and oxygen into the blender.

(4) Adjust the ventilator operating controls.

(5) Attach a test lung to the patient interface port of the patient valve.

(6) Analyze the delivered gas with a calibrated oxygen analyzer.

(7) Remove the test lung.

(8) Connect the patient's face mask, endotracheal tube, or tracheostomy tube.

b. Low flow. The auxiliary gas outlet, located on the right side of the blender, is intended for use in situations requiring the use of a flowmeter. When a flowmeter is attached to the auxiliary outlet, a small bleed of gas (10 to 12 lpm) will occur. Operation of the blender with low flow applications is as follows:

(1) Install the flowmeter to the auxiliary gas outlet.

NOTE

An elbow adapter may be required for unrestricted visual observation or use.

(2) Adjust the concentration control knob to the desired oxygen concentration.

(3) Turn on both air and oxygen into the blender.

(4) Adjust the flowmeter to the desired setting.

(5) Attach a test lung to the patient interface port of the patient valve.

(6) Analyze the delivered gas with a calibrated oxygen analyzer.

(7) Remove the test lung.

(8) Connect the patient's face mask, endotracheal tube, or tracheostomy tube.

3-6. Performance checks.

Complete the performance checks listed in table 3-3 after completing the set-up procedures, but before placing the ventilator into clinical use.

Table 3-3. Blender alarm/bypass checks.

NOTE

Gas must be flowing through the blender to complete the following checks.

ACTION	RESPONSE
1. Turn the oxygen and air valves on and adjust the concentration control knob to 60 percent.	Neither the audible alarm nor the bypass function should activate.
2. Connect an oxygen flowmeter to the auxiliary gas outlet to activate the bleed circuit.	Audible alarm starts.
3. Disconnect the air source from the blender.	Audible alarm starts.
4. Reconnect the air source removed in procedure 3 above. Adjust the concentration control knob to 60 percent.	Audible alarm stops.
5. Disconnect the oxygen source from the blender.	Audible alarm starts.
6. Reconnect the oxygen source to the blender.	Audible alarm stops.
7. Set oxygen flowmeter, connected to the auxiliary gas outlet in procedure 2 above, at 6 to 8 lpm.	Oxygen analyzer should indicate 60 percent ±3 percent.

3-7. Alarm conditions.

The blender alarm will be activated by any one of the following pressure differences.

a. Air or oxygen supply regulators are not adjusted to output pressure of 50 psi ±5 psi.

b. Air or oxygen cylinder contents have been used to an extent that results in a 20-psi drop in pressure.

c. Air or oxygen cylinder valves have been turned off or disconnected.

d. Air or oxygen connecting hoses or devices are restricting gas flow.

e. Air or oxygen regulators are not capable of meeting peak flow requirements, resulting in pressure reduction.

f. Blender gas inlet filters are occluded with contaminants.

g. Air or oxygen pressure varies by more than 20 psi of each other.

h. Air or oxygen hoses or interconnections are loose or disconnected.

Section V. CLEANING AND STERILIZING

3-8. Cleaning.

a. Wipe the blender daily with a soft, moist cloth.

b. Clean all exterior surfaces, after each patient use, with an all purpose liquid cleaner.

CAUTION

Do not immerse the blender into liquid cleaners or liquid decontamination agents to preclude interior damage.

NOTE

Do not use any abrasive cleaners or solvent cleaners on decals.

3-9. Sterilizing.

The blender can be sterilized with ethylene oxide gas.

CAUTION

Do not steam sterilize the blender or otherwise subject it to temperatures over 62°C (144°F).

Section VI. MAINTENANCE INSTRUCTIONS

3-10. General.

Procedures for adjusting, repairing, or calibrating the blender are not applicable to unit level maintenance. (Refer to chapter 5.)

3-11. Specific guidelines.

Elastomer components such as diaphragms and o-rings are designed to function satisfactorily for a minimum of 2 years. The need for cleaning and replacement will depend on the extent of contaminants and will be evidenced by the blender not meeting its specifications. A period of 3 years should be considered the maximum service interval under ideal conditions.

CHAPTER 4

UNIT LEVEL MAINTENANCE

Section I. GENERAL INFORMATION

4-1. Overview.

Maintenance functions, both preventive and corrective, that are beyond the scope of the user are assigned to unit level maintenance equipment repairer personnel. These personnel will perform the majority of maintenance required for the equipment except for some tasks involving the printed circuit boards (PCBs), gas components, membrane panel, manifold assembly, and the control module case. This chapter provides instructions and information to aid in performing the required tasks.

4-2. Tools and test equipment.

Common tools and test equipment required for unit level maintenance of the equipment are listed in appendix B, section III of this manual. Refer to your unit's modified table of organization and equipment (MTOE) for authorized items.

4-3. Components of end item and basic issue items.

Components of end item and basic issue items are listed in appendix C, sections II and III of this manual.

4-4. Expendable supplies.

Expendable and durable supplies and materials required for maintenance of the equipment are listed in appendix D, section II of this manual.

4-5. Repair parts.

Repair parts required for unit level maintenance are listed in appendix E, section II of this manual.

4-6. Special tools.

Special tools required for unit level maintenance of the equipment are listed in appendix E, section III of this manual.

4-7. Additional authorization list items.

Additional items required for augmented ventilation modes are identified in appendix F, section II of this manual.

Section II. SERVICE UPON RECEIPT OF EQUIPMENT

4-8. Unpacking the ventilator.

a. Open the cardboard shipping carton and remove the ventilator.

b. Unfasten the two pressure-lock latches.

c. Open the case.

d. Observe how the components are packed.

e. Remove the control module and set it aside.

NOTE

The battery pack may or may not be installed in the control module. Refer to paragraph 4-19b(8) or 4-22b(7) for battery pack installation procedures.

f. Unpack the case by removing the following items:

(1) Control module.
(2) Multivoltage power supply.
(3) Vehicle electrical power assembly.
(4) Manufacturer manuals (2).
(5) High pressure hose (green).
(6) Spiral hose.
(7) Transducer hose.
(8) Demand valve hose.
(9) Adult's airway.
(10) Child's airway.
(11) PEEP valve (disposable).
(12) Patient valve.
(13) Hose clips (5).
(14) Adult/child mask.
(15) Cushioned mask.

4-9. Assembling the ventilator.

Assemble the ventilator by following the procedures in chapter 2, sections IV and V.

CAUTION

Accessories not required for a particular ventilator assembly configuration or mode should be returned to the case for storage to prevent damage or loss.

Section III. LUBRICATION INSTRUCTIONS

4-10. General.

No lubrication of the ventilator is required.

WARNING

Never permit oil, grease, or other combustible substances to come in contact with the ventilator. Oxygen and gas mixtures containing large percentages of oxygen react chemically with organic materiels to produce heat. This can explode.

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-11. General.

a. The ventilator must be inspected and serviced systematically to ensure that it is ready for operation at all times. Inspection will allow defects to be discovered and corrected before they result in serious damage or failure. Table 4-1 contains a list of PMCS items to be performed by unit level maintenance personnel.

b. Preventive maintenance is not limited to performing the checks and services listed in the PMCS table. There are things you should do any time you see they need to be done, such as checking for general cleanliness, observing for improper operational indicators, and maintaining the proper quantities of operating supplies.

c. The following is a list of the PMCS table column headings with a description of the information found in each column:

(1) *Item No*. This column shows the sequence in which to do the PMCS, and is used to identify the equipment area on the Equipment Inspection and Maintenance Worksheet, DA Form 2404.

(2) *Interval*. This column shows when each PMCS item is to be serviced: **B** - Before Operation, **D** - During Operation, **A** - After Operation, **M** - Monthly, and **S** - Semiannually. **B**, **D**, and **A** should be performed with daily use of the equipment.

NOTE

> When the ventilator must be kept in continuous operation, check and service only those items that will not disrupt operation. Perform the complete daily checks and services when the equipment can be shut down.

(3) *Item to be Inspected and Procedure*. This column identifies the general area or specific part to be checked or serviced.

(4) *Equipment is not Ready/Available If:*. This column lists conditions that make the equipment unavailable or unusable.

Table 4-1. Preventive maintenance checks and services.

ITEM NO	INTERVAL					ITEM TO BE INSPECTED AND PROCEDURE	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	M	S		
1.				X	X	**Case**. Check for wear, loose or missing hardware, and cracks.	The unserviceable case prevents protective storage or safe movement.
2.	X	X	X	X	X	**Accessories.**	
						a. Inspect hoses, fittings, and regulators for cracks, crimps, leakage, discoloration, damaged connector fittings, or general wear.	Unserviceable accessories prevent use of the ventilator.
						b. Check for missing accessories.	Missing accessories prevent use of the ventilator.
3.	X		X	X	X	**Battery**. Test the control module for proper operation using the internal battery. Check for a battery alarm condition.	The discharged battery causes an alarm condition.
4.	X		X	X	X	**Multivoltage power supply.**	
						a. Check the power supply for worn, cracked, or exposed electrical wire(s) and connectors.	The ventilator cannot be operated or operates, but causes an electrical hazard.
						b. Test the operation of the power supply and the integrated battery charger.	The multivoltage power supply is inoperable.

Table 4-1. Preventive maintenance checks and services - continued.

ITEM NO	INTERVAL					ITEM TO BE INSPECTED AND PROCEDURE	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	M	S		
						NOTE Observe that the EXT POWER indicator illuminates and ensure that the EXTERNAL POWER LOW/FAIL ALARM is not activated.	
5.	X	X	X		X	**Patient valve.** Check for cracks, leakage, discoloration, and general wear.	The patient valve is inoperable, malfunctioning, or endangers the patient.
6.	X	X	X	X	X	**Blender.** Inspect for damage to fittings or the concentration control.	The damage prevents operation of the ventilator.
7.	X	X	X	X	X	**Control module.**	
						a. Check for tactile feel and operation of all controls.	Any control is inoperable.
						b. Verify completion of self-test.	Any portion of the self-test aborts or fails.
						c. Check the various modes of operation.	Any procedure of any mode is defective or inoperable.

4-12. Reporting deficiencies.

If operator personnel discover problems with the equipment during PMCS that they are unable to correct, they must report them. Refer to TB 38-750-2 and report the deficiency using the proper forms. Consult with your unit level medical equipment repairer if you need assistance.

Section V. BATTERY CARE AND RECHARGING

4-13. Type of battery.

The ventilator uses sealed, maintenance free, rechargeable, lead-acid batteries of the starved electrolyte type which provides a wide temperature operating range. The batteries do not exhibit memory (reduced capacity) characteristics or vent hydrogen gas. The batteries are assembled and packaged into a battery pack.

4-14. Battery care and recharging.

The life of the ventilator battery pack depends, to a great extent, on its care. Sealed lead-acid batteries exhibit excellent charge retention characteristics and prolonged periods when they are not used will not substantially reduce their operating capability. However, if the ventilator is not used for long periods of time, the batteries should be recharged monthly. This will ensure that the battery charge is maintained at a minimum of 80 percent of capacity. Recharge time ranges from 14 to 16 hours, depending on the initial state of discharge. Continuous charging can be performed—

a. by using the multivoltage power supply,

b. by using the external 11 to 30 VAC/VDC power cable, or

c. by using the vehicle electrical power assembly.

NOTE

The EXT POWER lamp illuminates when the control module is correctly connected to a proper source of electrical power.

Do not charge the battery pack when the temperature range exceeds -20°C (-4°F) to 50°C (122°F).

When the ventilator is operating and connected to an external source of electrical power, the ventilator will default to the external source of electrical power to preserve the internal battery pack for portable or transport use, as emergency backup, or for recharging purposes.

The control module includes a dedicated battery pack charging circuit. This ensures that recharging timeframes will be identical during operating or non-operating periods.

Section VI. TROUBLESHOOTING

4-15. General.

a. General troubleshooting information for locating and correcting many of the operating malfunctions which may develop in the ventilator is located in table 4-2. Symptoms are provided for common malfunctions. Each symptom is followed by possible causes and corrective actions.

NOTE

Keep jewelry and liquids away from the control module when operating it without the lower case during troubleshooting procedures.

b. This manual cannot list all possible malfunctions. If a malfunction is not listed or is not determined by routine diagnostic procedures, notify your appropriate maintenance support unit.

Table 4-2. General troubleshooting.

SYMPTOM
  POSSIBLE CAUSE
    CORRECTIVE MAINTENANCE

1. VENTILATOR INOPERABLE ON EXTERNAL ELECTRICAL POWER.

Defective multivoltage power supply.

Repair or replace power supply.

Inadequate source of electrical power.

Test and initiate corrective action.

Defective control module.

Test and repair or replace the defective analog/power supply PCB or circuitry.

2. VENTILATOR INOPERABLE ON INTERNAL BATTERY PACK.

Low battery electrical power.

Check battery pack and recharge or replace batteries.

Defective control module.

Test and repair or replace the analog/power supply PCB or circuitry.

Table 4-2. General troubleshooting - continued.

SYMPTOM
- **POSSIBLE CAUSE**
    - **CORRECTIVE MAINTENANCE**

- Defective battery charging circuit.
    - Repair circuitry.

3. NO GAS FLOW TO PATIENT CIRCUIT.

- Defective manifold assembly solenoid.
    - Test and repair or replace solenoid.
- Loose PCB cable connector(s).
    - Reseat connector(s).
- Disconnected hose(s).
    - Reconnect hose(s).

4. LOW GAS OUTPUT FLOW TO PATIENT.

- Input gas pressures low.
    - Adjust input gas pressures.

4-16. Indicator, display, or alarm troubleshooting.

Specific troubleshooting procedures are built into the ventilator. Refer to the following chapter and sections:

a. Indicators and displays - chapter 2, section II.

b. Self-test - chapter 2, section V.

c. Transducer calibration - chapter 2, section V.

d. Alarm functions, chapter 2, section VIII.

4-17. Electrical schematics, wiring diagrams, and pictorials.

a. Electrical schematics, wiring diagrams, and pictorials of PCBs are provided at the end of this chapter in figures 4-15 through 4-19 to assist you when troubleshooting. Isolate the problem to a functional segment of the circuitry.

b. Additional information about the electrical/electronic schematics, wiring diagrams, and pictorials are as follows:

(1) Electronic connectors are shown in figures 4-15, 4-16, 4-18, and 4-19.

(2) Charts providing associated electronic information are shown in figures 4-16, 4-17, and 4-19.

(3) Figures 4-15, 4-18, and 4-19 have wiring that interconnects.

Section VII. DISASSEMBLY AND ASSEMBLY INSTRUCTIONS (MODEL 750M)

4-18. General.

a. Procedures for disassembly, assembly, and replacement of components for the model 750M are provided in this section of the manual.

b. Disassembly procedures for the electronic modules and associated components are continuous from the case (para 4-19a(1)) through the membrane panel (para 4-19a(8)). Likewise, assembly procedures are continuous from the membrane panel (para 4-19b(1)) through the case (para 4-19b(8)).

NOTE

Ensure that a malfunction is not accessory related, prior to starting corrective maintenance.

c. Disassembly procedures for the pneumatic assemblies and associated components are continuous from the case (para 4-20a(1) through the connector panel (para 4-20a(2)). Likewise, assembly procedures are continuous from the connector panel (para 4-20b(1)) to the case (para 4-20b(2)).

WARNING

Use an electromagnetic interference (EMI) workstation when disassembling, assembling, or performing maintenance inside the control module case to prevent damage to sensitive electronic components.

4-19. Electronic modules and associated components.

a. Disassembly.

(1) *Case.*

(a) Disconnect any external source of electrical power from the connector panel of the control module.

(b) Verify that the MODE selector switch is in the OFF position.

(c) Disconnect all hoses from the connector panel.

(d) Open the battery compartment door by simultaneously pulling the spring-loaded door latch clips outward and then swinging the door upward.

(e) Pull the battery pack electrical connectors apart.

(f) Remove the battery pack by lifting it with the plastic holder and set it aside.

(g) Close the battery compartment door, but do not latch it.

(h) Turn the control module over and set it down with the operating controls facing down.

CAUTION

Rest the control module on a soft cloth to prevent marring the case or the operating controls protective cover.

(i) Remove the two Phillips screws to unfasten the battery compartment bracket.

(j) Remove the four Phillips screws, located on the upper and lower ends, which fasten the upper and lower control module cases together.

(k) Lift the lower case from the upper case and set it aside.

(l) Complete the maintenance requiring removal of the lower case or proceed to the next disassembly sequence.

(2) *Battery compartment bracket.*

(a) Remove the three Phillips screws and washers holding the battery compartment bracket to the hex-shaped spacers fastened to the upper case.

(b) Remove two Phillips screws, washers, and nuts fastening the bracket to the linear regulators' PCB bracket.

(c) Remove the bracket and set it aside.

(d) Complete the maintenance requiring removal of the battery compartment bracket or proceed to the next disassembly sequence.

(3) *Linear regulators PCB (fig 4-1).*

(a) Remove the two slotted screws and fiber washers from the aluminum mounting bracket for the linear regulators PCB.

NOTE

The two screws thread into hex-shaped spacers mounted on the analog/power supply PCB.

(b) Pull the mounting bracket gently upward to separate the linear regulators PCB from the connector of the analog/power supply PCB. Set it aside.

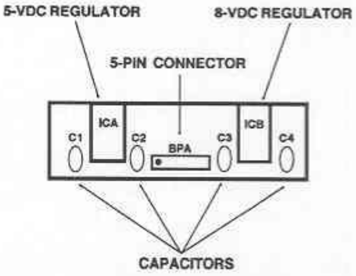

5-VDC REGULATOR
8-VDC REGULATOR
5-PIN CONNECTOR
ICA
ICB
C1
C2
BPA
C3
C4
CAPACITORS

Figure 4-1. Linear regulators PCB (model 750M).

CAUTION

Ensure that the projecting connector pins are protected to preclude bending which would make reassembly difficult.

(c) Complete the maintenance requiring removal of the linear regulators PCB or proceed to the next disassembly sequence.

(4) *Analog/power supply PCB (fig 4-2).*

(a) Remove the two slotted screws and fiber washers that fasten the lower end of the PCB.

NOTE

These screws thread into hex-shaped spacers which separate the analog/power supply PCB from the EMI shield. The spacers should be held immobile to prevent their rotation.

(b) Remove the two hex-shaped spacers that fasten the upper end of the PCB.

(c) Remove the 5-pin female connector from the PCB by rocking it gently back and forth until free.

(d) Remove the plastic tubing from the transducer port on the PCB.

(e) Remove the analog/power supply PCB by gently rocking the multi-pin connector back and forth while simultaneously pulling it upward. Set it aside.

(f) Complete the maintenance requiring removal of the analog/power supply PCB or proceed to the next disassembly sequence.

(5) *EMI shield.*

(a) Remove the four hex-shaped spacers which fasten the EMI shield to the CPU PCB and lift off the shield. Set it aside.

(b) Complete the maintenance requiring removal of the EMI shield or proceed to the next disassembly sequence.

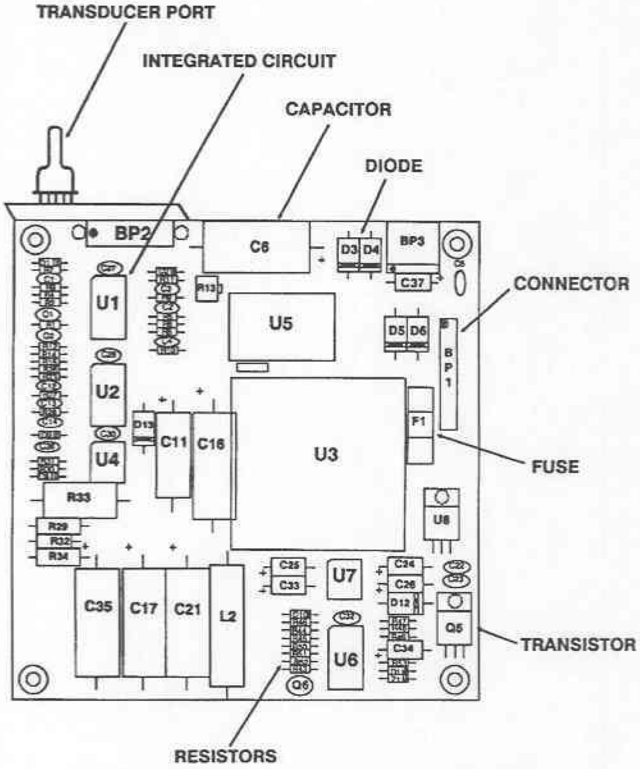

TRANSDUCER PORT
INTEGRATED CIRCUIT
CAPACITOR
DIODE
CONNECTOR
FUSE
TRANSISTOR
RESISTORS
BP2
C6
D3
D4
BP3
C37
U1
R13
U5
D5
D6
BP1
U2
D13
C11
C16
U3
F1
U4
R33
U8
R29
R32
R34
C35
C17
C21
L2
C25
C33
U7
C24
C26
D12
Q5
C34
U6
Q6

Figure 4-2. Analog/power supply PCB (model 750M).

(6) *CPU PCB (fig 4-3).*

(a) Remove the four hex-shaped spacers and the two slotted screws with fiber washers which fasten the PCB.

(b) Remove the ribbon connector from the PCB by rocking it back and forth.

(c) Remove the PCB by gently rocking it up and down to separate it from the multi-pin connector fastening it to the display PCB. Set it aside.

(d) Complete the maintenance requiring removal of the CPU PCB or proceed to the next disassembly sequence.

(7) *Display PCB (fig 4-4).*

(a) Remove the three hex-shaped spacers and one Keps nut.

(b) Carefully turn the control module over (operating controls facing up).

(c) Open the cover.

(d) Remove the cap from each of the six collet knobs.

(e) Loosen their locking screws and remove the six knobs.

(f) Remove the fastening nut around each knob shaft.

(g) Unscrew the MANUAL TRIGGER push button protective nut.

(h) Remove the MANUAL TRIGGER push button.

(i) Carefully turn the control module back over (operating controls facing down).

(j) Remove the ribbon connector between the display PCB and the membrane panel.

(k) Remove the PCB and set it aside.

(l) Complete the maintenance requiring removal of the display PCB or proceed to the next disassembly process.

(8) *Membrane panel.*

(a) Remove the three Keps nuts.

(b) Remove the three hex-shaped spacers.

NOTE

The manifold assembly should not be disassembled below the depot level of maintenance. The membrane panel and the manifold assembly should be removed as if one assembly.

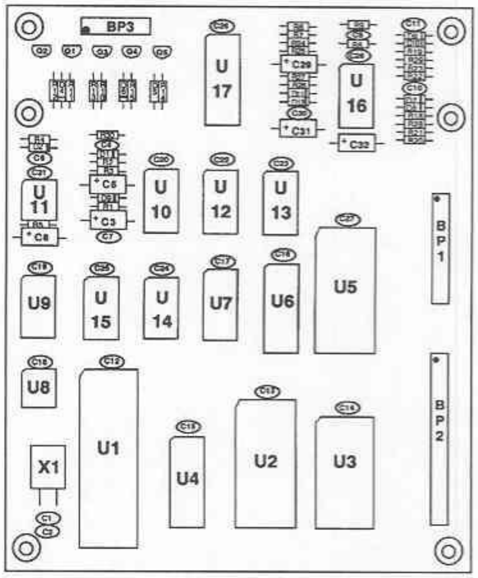


Figure 4-3. CPU PCB (model 750M).

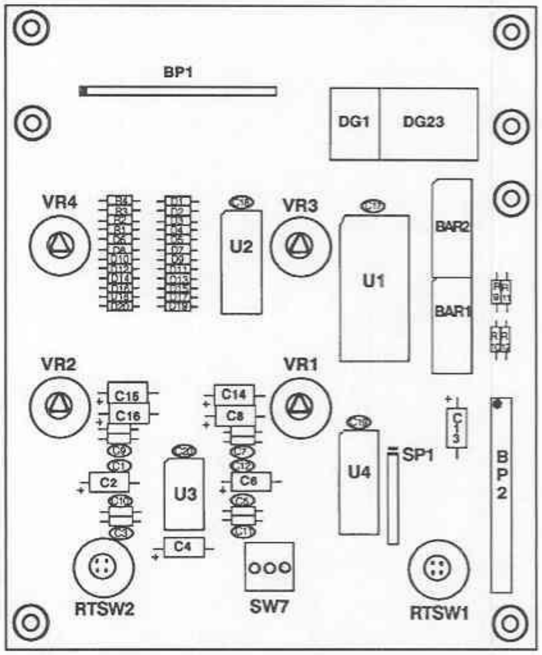


Figure 4-4. Display PCB (model 750M).

(c) Remove the membrane panel and manifold assembly from the upper case and set it aside.

(d) Complete the maintenance requiring removal of the membrane panel and manifold assembly.

b. Assembly.

(1) *Membrane panel.*

(a) Position the upper case with the operating controls facing down.

CAUTION

Rest the upper case on a soft cloth to prevent marring the case or the operating controls protective cover.

(b) Position the membrane panel and the manifold assembly into the upper case.

(c) Install the three hex-shaped spacers.

(d) Install the three Keps nuts.

(2) *Display PCB.*

(a) Position the PCB into the upper case.

(b) Fasten the ribbon connector from the membrane panel to the display PCB connector.

(c) Turn the control module over carefully (operating controls facing up).

(d) Install the MANUAL TRIGGER push button.

(e) Install the MANUAL TRIGGER push button protective nut.

(f) Install the nut around each collet knob shaft to fasten the display PCB to the membrane panel.

(g) Install the six collet knobs and tighten their locking screws. Then replace their caps.

CAUTION

Ensure that each control is in its fully counterclockwise position to permit proper knob pointer alignment. Otherwise, the full operating range of the control will not be usable.

(h) Close the operating controls protective cover.

(i) Turn the control module over carefully (operating controls facing down).

(j) Install the three hex-shaped spacers and one Keps nut.

(3) *CPU PCB.*

(a) Fasten the ribbon connector to its mate on the PCB.

(b) Install the PCB by aligning the multi-pin connector with its mating display PCB connector and carefully press downward while simultaneously aligning the PCB to enable the three threaded ends of the hex-shaped spacers to project upward through their mounting holes.

(c) Install the four hex-shaped spacers and the two slotted screws with fiber washers to fasten the PCB.

(4) *EMI shield.*

(a) Install the shield by aligning its mounting holes and the cut-out for upward projecting connector pins over the three threaded projections of the hex-shaped spacers and then seating it.

(b) Install the four hex-shaped spacers.

NOTE

One of these four hex-shaped spacers has a threaded projection on one end. The other three spacers are internally threaded in both ends.

(5) *Analog/power supply PCB.*

(a) Install the 5-pin female connector to the PCB.

(b) Connect the plastic tubing to the transducer port on the PCB.

(c) Align the multi-pin connector with the connector pins projecting upward through the cut-out in the EMI shield and gently press the PCB downward to engage the pins.

(d) Install the two hex-shaped spacers to fasten the upper end of the PCB.

(e) Install the two slotted screws and fiber washers to fasten the lower end of the PCB.

(6) *Linear regulators PCB.*

(a) Align the 5-pin connector with its mating connector on the analog/power supply PCB and gently push downward to seat it.

(b) Install the two slotted screws and fiber washers to fasten the mounting bracket for the PCB.

(7) *Battery compartment bracket.*

(a) Install the three Phillips screws and washers to fasten the bracket to hex-shaped spacers.

(b) Install the two Phillips screws, washers, and nuts to fasten the bracket to the mounting bracket for the linear regulators.

(8) *Case.*

(a) Place the lower case onto the upper case.

(b) Install the four Phillips screws, located on the upper and lower ends, which fasten the upper and lower cases together.

(c) Place the control module on a soft cloth with the operating controls facing down.

(d) Install the two Phillips screws and washers into the back of the case.

(e) Turn the control module over again with the operating controls facing up.

(f) Open the battery compartment door.

(g) Install the battery pack with the plastic holder by lowering it into the battery compartment.

(h) Push the two battery pack electrical connectors together.

(i) Close and latch the battery compartment door by simultaneously pulling the spring-loaded latch clips outward and then swinging the door into place. Reset the latch clips.

(j) Reconnect all hoses to the control panel.

(k) Connect the external source of electrical power, if required.

(l) Test the ventilator.

4-20. Pneumatic assemblies and associated components.

a. Disassembly.

(1) *Case.*

(a) Disconnect any external source of electrical power from the connector panel of the control module.

(b) Verify that the MODE selector switch is in the OFF position.

(c) Disconnect all hoses from the connector panel.

(d) Open the battery compartment door by simultaneously pulling the spring-loaded door latch clips outward and then swinging the door upward.

(e) Pull the battery pack electrical connectors apart.

(f) Remove the battery pack by lifting it with the plastic holder and set it aside.

(g) Close the battery compartment door, but do not latch it.

(h) Turn the control module over and set it down with the operating controls facing down.

CAUTION

Rest the control module on a soft cloth to prevent marring the case or the operating controls protective cover.

(2) *Connector panel (fig 4-5).*

(a) Remove the hex nut fastening the GAS IN port.

(b) Remove the hex nut fastening the GAS OUT port.

(c) Remove the two Phillips screws, washers, and nuts fastening the ALARM assembly.

(d) Remove the two Phillips screws, four flat washers, and two Keps nuts to loosen the EXT POWER jack.

NOTE

Observe and record the orientation of the EXT POWER jack for subsequent replacement.

b. Assembly.

(1) *Connector panel.*

(a) Reinstall the EXT POWER jack by replacing the two Phillips screws, four flat washers, and the two Keps nuts.

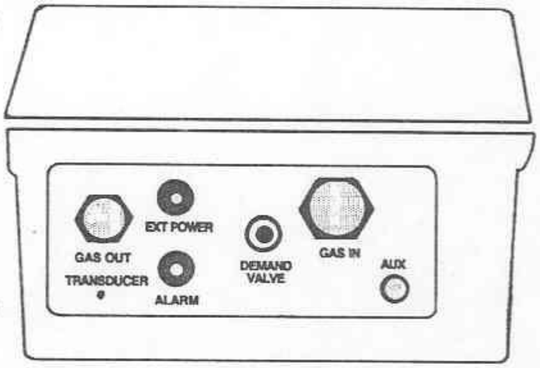


Figure 4-5. Connector panel markings.

NOTE

Ensure that the EXT POWER jack is correctly oriented.

(b) Reinstall the two Phillips screws, washers, and nuts to refasten the ALARM assembly.

(c) Position the panel into place.

(d) Reinstall the hex nut to refasten the GAS OUT port.

(e) Reinstall the hex nut to refasten the GAS IN port.

(2) *Case.*

(a) Open the battery compartment door.

(b) Install the battery pack with the plastic holder by lowering it into the battery compartment.

(c) Push the two battery pack electrical connectors together.

(d) Close and latch the battery compartment door by simultaneously pulling the spring-loaded door latch clips outward and then swinging the door into place. Reset the latch clips.

(e) Reconnect all hoses to the connector panel.

(f) Connect the external source of electrical power, if required.

(g) Test the ventilator.

Section VIII. DISASSEMBLY AND ASSEMBLY INSTRUCTIONS (MODEL 750)

4-21. General.

a. Procedures for disassembly, assembly, and replacement of components for the model 750 are provided in this section of the manual.

b. Disassembly procedures for the electronic modules and associated components are continuous from the case (para 4-22a(1)) through the membrane panel (para 4-22a(7)). Likewise, assembly procedures are continuous from the membrane panel (para 4-22b(1)) through the case (para 4-22b(7)).

c. Disassembly procedures for the pneumatic assemblies and associated components are continuous from the case (para 4-23a(1)) through the connector panel (para 4-23a(2)). Likewise, assembly procedures are continuous from the connector panel (4-23b(1)) through the case (para 4-23b(2)).

WARNING

Use an EMI workstation when disassembling, assembling, or performing maintenance inside the control module case to prevent damage to sensitive electronic components.

4-22. Electronic modules and associated components.

a. Disassembly.

(1) *Case.*

(a) Disconnect any external source of electrical power from the connector panel of the control module.

(b) Verify that the MODE selector switch is in the OFF position.

(c) Disconnect all hoses from the connector panel.

(d) Open the battery compartment door by rotating its two latching knobs 180 degrees and then swinging the door upward.

(e) Pull the battery pack electrical connectors apart.

(f) Open the hook-and-loop straps holding the battery pack.

(g) Remove the battery pack and set it aside.

(h) Remove the two Phillips screws located in the upper and lower left corners of the compartment.

(i) Close, but do not latch the battery compartment door.

(j) Turn the control module over with the operating controls facing down.

CAUTION

Rest the control module on a soft cloth to prevent marring the case or the operating controls protective cover.

(k) Remove the two Phillips screws from recessed mounting holes just inside the case handle mounting posts.

(l) Remove the four Phillips screws from recessed mounting holes located on the upper and lower ends.

(m) Lift the lower case from the upper case and set it aside.

(n) Complete the maintenance requiring removal of the lower case or proceed to the next disassembly sequence.

(2) *Linear regulators/EMI shield (fig 4-6).*

(a) Remove the four slotted screws and lock washers from each corner of the shield.

NOTE

The screws thread into hex-shaped spacers mounted on the analog/power supply PCB.

(b) Pull the EMI shield gently upward to separate the linear regulators PCB connector from the connector on the analog/power supply PCB. Set it aside.

CAUTION

Ensure that the projecting connector pins are protected to preclude bending which would make reassembly difficult.

(c) Complete the maintenance requiring removal of the EMI shield/linear regulators or proceed to the next disassembly sequence.

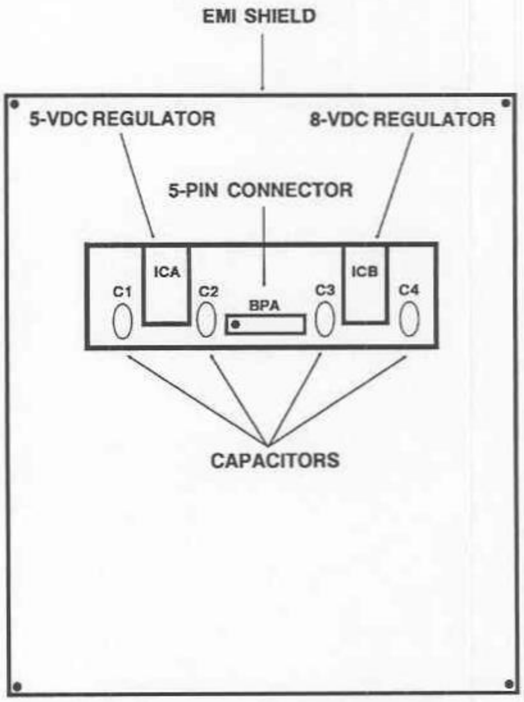


Figure 4-6. Linear regulators and EMI shield (model 750).

(3) *Analog/power supply PCB (fig 4-7).*

(a) Remove the four hex-shaped spacers from each corner of the PCB.

(b) Remove the 5-pin female connector from the PCB by rocking it gently back and forth until free.

(c) Remove the plastic tubing from the transducer port.

(d) Remove the analog/power supply PCB by gently rocking the multi-pin connector back and forth while simultaneously pulling upward. Set it aside.

(e) Complete the maintenance requiring removal of the analog/power supply PCB or proceed to the next disassembly sequence.

(4) *EMI shield.*

(a) Remove the four hex-shaped spacers which fasten the EMI shield to the CPU PCB and lift the shield. Set it aside.

(b) Complete the maintenance requiring removal of the shield or proceed to the next disassembly sequence.

(5) *CPU PCB (fig 4-8).*

(a) Remove the four hex-shaped spacers and the two slotted screws with fiber washers which fasten the PCB.

(b) Remove the ribbon connector from the PCB by rocking it back and forth.

(c) Remove the PCB by gently rocking it while simultaneously pulling upward to separate the multi-pin connector fastening it to the display PCB. Set it aside.

(d) Complete the maintenance requiring removal of the CPU PCB or proceed to the next disassembly sequence.

(6) *Display PCB (fig 4-9).*

(a) Remove the three hex-shaped spacers and one Keps nut.

(b) Carefully turn the control module over (operating controls facing up).

(c) Open the cover.

(d) Remove the cap from each of the six collet knobs.

(e) Loosen their locking screws and remove the six knobs.

(f) Remove the fastening nut around each knob shaft.

(g) Unscrew the MANUAL TRIGGER push button protective nut.

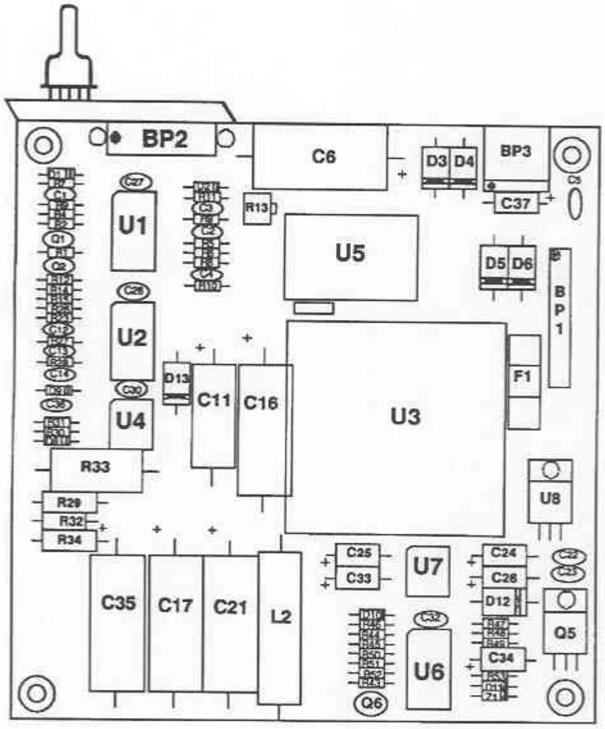

BP2
C6
D3
D4
BP3
C37
C27
U1
R13
U5
D5
D6
BP1
C28
U2
D13
C11
C16
U3
F1
C30
U4
R33
U8
R29
R32
R34
C35
C17
C21
L2
C25
C33
U7
C24
C26
D12
Q5
C32
U6
C34
Q6

Figure 4-7. Analog/power supply PCB (model 750).

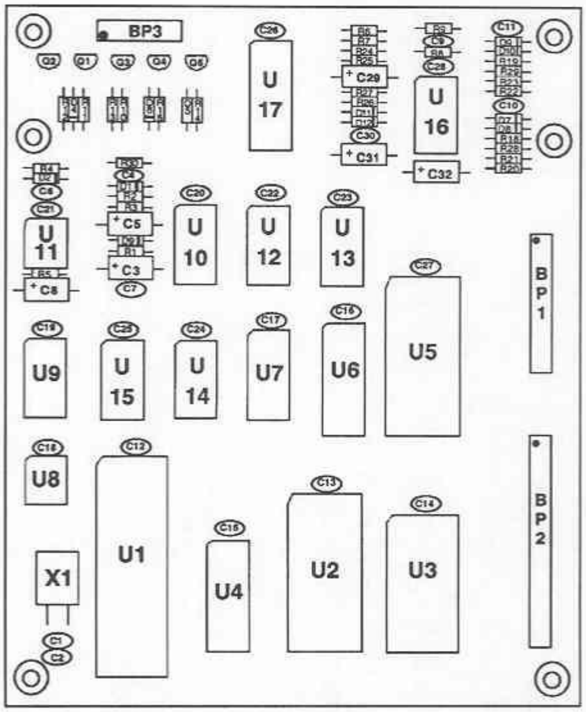

BP3
C26
U17
C29
C31
U16
C32
C20
C22
C23
U11
C5
C3
C8
C7
U10
U12
U13
C27
BP1
C19
C25
C24
C17
C16
U9
U15
U14
U7
U6
U5
C18
C12
U8
C13
C14
C15
BP2
X1
U1
U4
U2
U3
C1
C2

Figure 4-8. CPU PCB (model 750).

(h) Remove the MANUAL TRIGGER push button.

(i) Carefully turn the control module back over (operating controls facing down).

(j) Remove the ribbon connector between the display PCB and the membrane panel.

(k) Remove the PCB and set it aside.

(l) Complete the maintenance requiring removal of the display PCB or proceed to the next disassembly process.

(7) *Membrane panel.*

(a) Remove the three Keps nuts.

(b) Remove the three hex-shaped spacers.

NOTE

> The manifold assembly should not be disassembled below the depot level of maintenance. The membrane panel and the manifold assembly should be removed as if one assembly.

(c) Remove the membrane panel and manifold assembly from the upper case and set it aside.

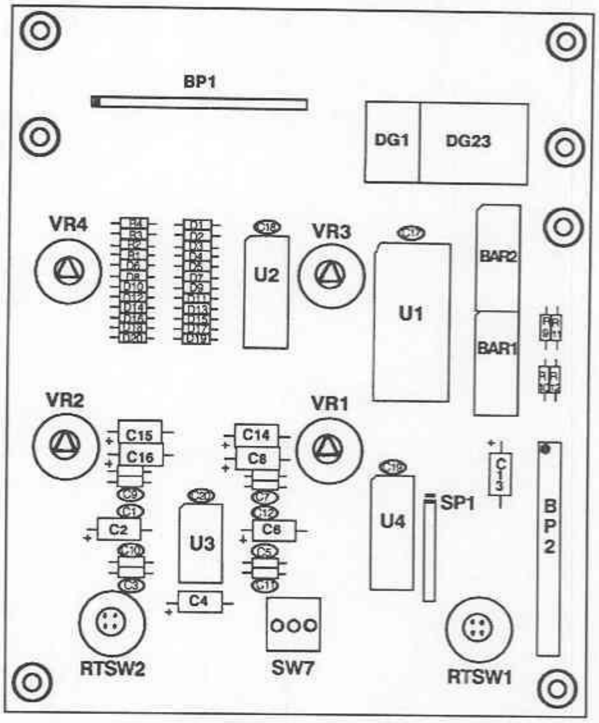

BP1
DG1
DG23
VR4
R4
R3
R2
R1
D6
D8
D10
D12
D14
D16
D18
D20
D1
D2
D3
D4
D5
D7
D9
D11
D13
D15
D17
D19
C18
U2
VR3
C17
U1
BAR2
BAR1
R9
R11
R10
R12
VR2
C15
C16
C9
C1
C2
C10
C3
C20
U3
C4
C14
C8
C7
C12
C6
C5
C11
VR1
C19
U4
SP1
C13
BP2
RTSW2
SW7
RTSW1

Figure 4-9. Display PCB (model 750).

(d) Complete the maintenance requiring removal of the membrane panel and manifold assembly.

b. Assembly.

(1) *Membrane panel.*

(a) Position the upper case with the operating controls facing down.

CAUTION

> Rest the upper case on a soft cloth to prevent marring the case or the operating controls protective cover.

(b) Position the membrane panel and the manifold assembly into the upper case.

(c) Install the three hex-shaped spacers.

(d) Install the three Keps nuts.

(2) *Display PCB.*

(a) Position the PCB into the upper case.

(b) Fasten the ribbon connector from the membrane panel to the display PCB connector.

(c) Turn the control module over carefully (operating controls facing up).

(d) Install the MANUAL TRIGGER push button.

(e) Install the MANUAL TRIGGER push button protective nut.

(f) Install the nut around each collet knob shaft to fasten the display PCB to the membrane panel.

(g) Install the six collet knobs and tighten their locking screws. Then replace their caps.

CAUTION

> Ensure that each control is in its fully counterclockwise position to permit proper knob pointer alignment. Otherwise, the full operating range of the control will not be usable.

(h) Close the operating controls protective cover.

(i) Turn the control module over carefully (operating controls facing down).

(j) Install the three hex-shaped spacers and one Keps nut.

(3) *CPU PCB.*

(a) Fasten the ribbon connector to its mate on the PCB.

(b) Install the PCB by aligning the multi-pin connector with the mating display PCB connector and carefully pressing downward while simultaneously aligning the PCB to enable the three threaded ends of hex-shaped spacers to project upward through the mounting holes.

(c) Install the four hex-shaped spacers and the two slotted screws with fiber washers to fasten the PCB.

(4) *EMI shield.*

(a) Install the shield by aligning its mounting holes and the cut-out for upward projecting connector pins over the three threaded projections of the hex-shaped spacers and then seating it.

(b) Install the four hex-shaped spacers.

NOTE

One of these four hex-shaped spacers has a threaded projection on one end. The other three spacers are internally threaded in both ends.

(5) *Analog/power supply PCB.*

(a) Install the 5-pin female connector to the PCB.

(b) Connect the plastic tubing to the transducer port on the PCB.

(c) Align the multi-pin connector with the connector pins projecting upward through a cut-out in the EMI shield and gently press the PCB downward to engage the pins.

(d) Install the two hex-shaped spacers to fasten the upper end of the PCB.

(e) Install the two slotted screws and fiber washers to fasten the lower end of the PCB.

(6) *Linear regulators/EMI shield.*

(a) Insert the linear regulators PCB 5-pin connector into the connector on the analog/power supply PCB.

(b) Install the four slotted screws and lockwashers into each corner of the shield.

(7) *Case.*

(a) Place the lower case onto the upper case.

(b) Install the six Phillips screws, located in recessed mounting holes inside the handle mounting posts and both the upper and lower ends of the case, to fasten the upper and lower cases together.

(c) Turn the control module over with the operating controls facing up.

(d) Open the battery compartment door.

(e) Install the two Phillips screws in the upper and lower left corners to complete the fastening of the upper and lower cases together.

(f) Lift the hook-and-loop straps and lay them over the edges of the battery compartment.

(g) Place the battery pack into its holder.

(h) Close the hook-and-loop straps to fasten the battery pack in the compartment.

(i) Push the battery pack electrical connectors together.

(j) Close and lock the battery compartment door by rotating the latching knobs 180 degrees.

(k) Connect all hoses to the connector panel.

(l) Reconnect any external source of electrical power, as required.

(m) Test the ventilator.

4-23. Pneumatic assemblies and associated components.

a. Disassembly.

(1) *Case.*

(a) Disconnect any external source of electrical power from the connector panel of the control module.

(b) Verify that the MODE selector switch is in the OFF position.

(c) Disconnect all hoses from the connector panel.

(d) Open the battery compartment door by rotating its two latching knobs 180 degrees and then swinging the door open.

(e) Pull the battery pack electrical connectors apart.

(f) Open the hook-and-loop straps holding the battery pack.

(g) Remove the battery pack and set it aside.

(h) Remove the two Phillips screws located in the upper and lower left corners of the compartment.

(i) Close, but do not latch the battery compartment door.

(j) Turn the control module over with the operating controls facing down.

CAUTION

Rest the control module on a soft cloth to prevent marring the case or the operating controls protective cover.

(k) Remove the two Phillips screws from recessed mounting holes just inside the case handle mounting posts.

(l) Remove the four Phillips screws from recessed mounting holes located on the upper and lower ends.

(m) Lift the lower case from the upper case and set it aside.

(n) Complete the maintenance requiring removal of the lower case or proceed to the next disassembly sequence.

(2) *Connector panel (fig 4-10).*

(a) Remove the hex nut fastening the GAS IN port.

(b) Remove the hex nut fastening the GAS OUT port.

(c) Remove the hex nut fastening the AUX jack.

(d) Remove the connector panel.

(e) Complete the corrective maintenance.

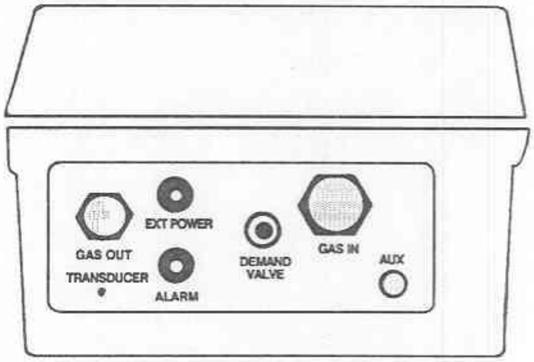


Figure 4-10. Connector panel.

b. Assembly.

(1) *Connector panel.*

(a) Position the panel into place.

(b) Reinstall the hex nut to refasten the AUX jack.

(c) Reinstall the hex nut to refasten the GAS OUT port.

(d) Reinstall the nex nut to refasten the GAS IN port.

(2) *Case.*

(a) Place the lower case onto the upper case.

(b) Install the six Phillips screws, located in recessed mounting holes inside the handle mounting posts and both the upper and lower ends of the case, to fasten the upper and lower cases together.

(c) Turn the control module over with the operating controls facing up.

(d) Open the battery compartment door.

(e) Install the two Phillips screws in the upper and lower left corners to complete the fastening of the upper and lower cases together.

(f) Lift the hook-and-loop straps and lay them over the edges of the battery compartment.

(g) Place the battery pack into its holder.

(h) Close the hook-and-loop straps to fasten the battery pack in the compartment.

(i) Push the battery pack electrical connectors together.

(j) Close and lock the battery compartment door by rotating the latching knobs 180 degrees.

(k) Connect all hoses to the connector panel.

(l) Reconnect any external source of electrical power, as required.

(m) Test the ventilator.

Section IX. CALIBRATION INSTRUCTIONS

4-24. General.

The ventilator self-test (refer to para 2-12) checks the transducer calibration and activates an audible tone and alphanumeric display if the calibration is out of tolerance. Paragraph 2-13 provides the transducer calibration procedures. Should this calibration fail to establish a zero baseline, an internal calibration will be required.

4-25. Internal transducer calibration procedures.

a. Access the PCBs by completing the disassembly procedures contained in this chapter, section VII or section VIII, depending on your ventilator model.

b. Set the control module upright by resting it on its lower end.

c. Open the operating controls protective cover.

d. Turn the MODE selector switch to the CAL position.

e. Adjust resistor number R13 on the analog/power supply PCB until the bar graph display light emitting diodes (LEDs) show 0 cm H_2O.

NOTE

Removal of the PCBs is not required to adjust R13 depicted on figure 4-11.

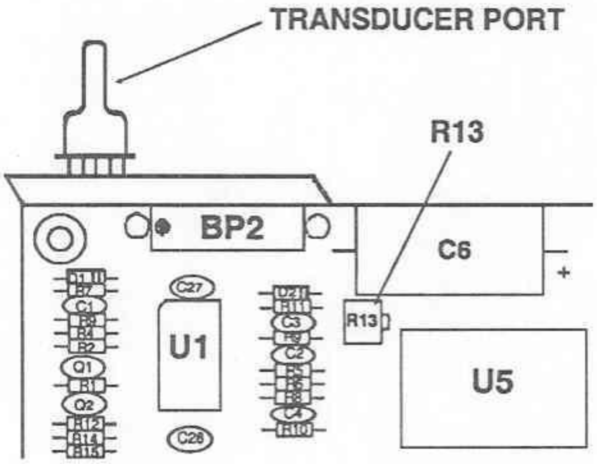


Figure 4-11. Calibration adjustment resistor.

f. Turn the MODE selector switch to the OFF position and then turn it back to any MODE position.

g. Ensure that the alphanumeric display shows "00" during the self-test.

NOTE

> The zero baseline can also be verified by turning the MODE selector switch to the CAL position.

h. Reassemble the control module by following the reassembly procedures contained in this chapter, section VII or section VIII, depending on your ventilator model.

4-26. Calibration difficulties.

a. If at least one LED of the bar graph display does not illuminate in the CAL position of the MODE selector switch, turn the selector switch to the OFF position and then back to the CAL position.

b. No bar graph display illumination when the MODE selector switch is in the CAL position indicates malfunctioning of the bar graph display circuitry.

Section X. CIRCUIT DESCRIPTIONS

4-27. General.

a. Circuit descriptions are identified to four PCBs. In turn, each component has been assigned a suffix designator and a "geographical" reference. Suffix designators are as follows:

(1) -1: analog/power supply PCB.

(2) -2: CPU PCB.

(3) -3: display PCB.

(4) -4: membrane panel PCB.

Examples: U1-1 indicates U1 on the analog/power supply PCB and U1-2 indicates U1 on the CPU PCB.

b. Components are identified as they appear in wiring diagrams or PCB illustrations.

c. Capitalized abbreviations in the text of circuit descriptions can be located on the wiring diagrams.

4-28. Electrical power circuits (fig 4-12).

a. First stage power regulator.

(1) This circuit consists of components U3-1, C7-1, and C8-1.

(2) The circuit input voltage in +12 VDC and the voltage output is +8 VDC.

b. Second stage power regulator.

(1) *Battery charger switching power supply.*

(a) This circuit consists of components U4-1, R25-1 through R33-1, C12-1 through C14-1, C16-1, C36-1, D8-1, D9-1, and L2-1.

(b) The circuit input voltage is +8 VDC and the voltage output is 14.2 VDC.

(2) *Power regulator (+5 VDC).*

(a) This circuit consists of components U5-1, C17-1, C18-1, and C19-1.

(b) The circuit input voltage is +8 VDC and the voltage output is +5 VDC.

(3) *Power regulator (+6 VDC).*

(a)This circuit consists of components U8-1, C22-1, C23-1, and C24-1.

(b) The circuit input voltage is +8 VDC and the voltage output is +6 VDC.

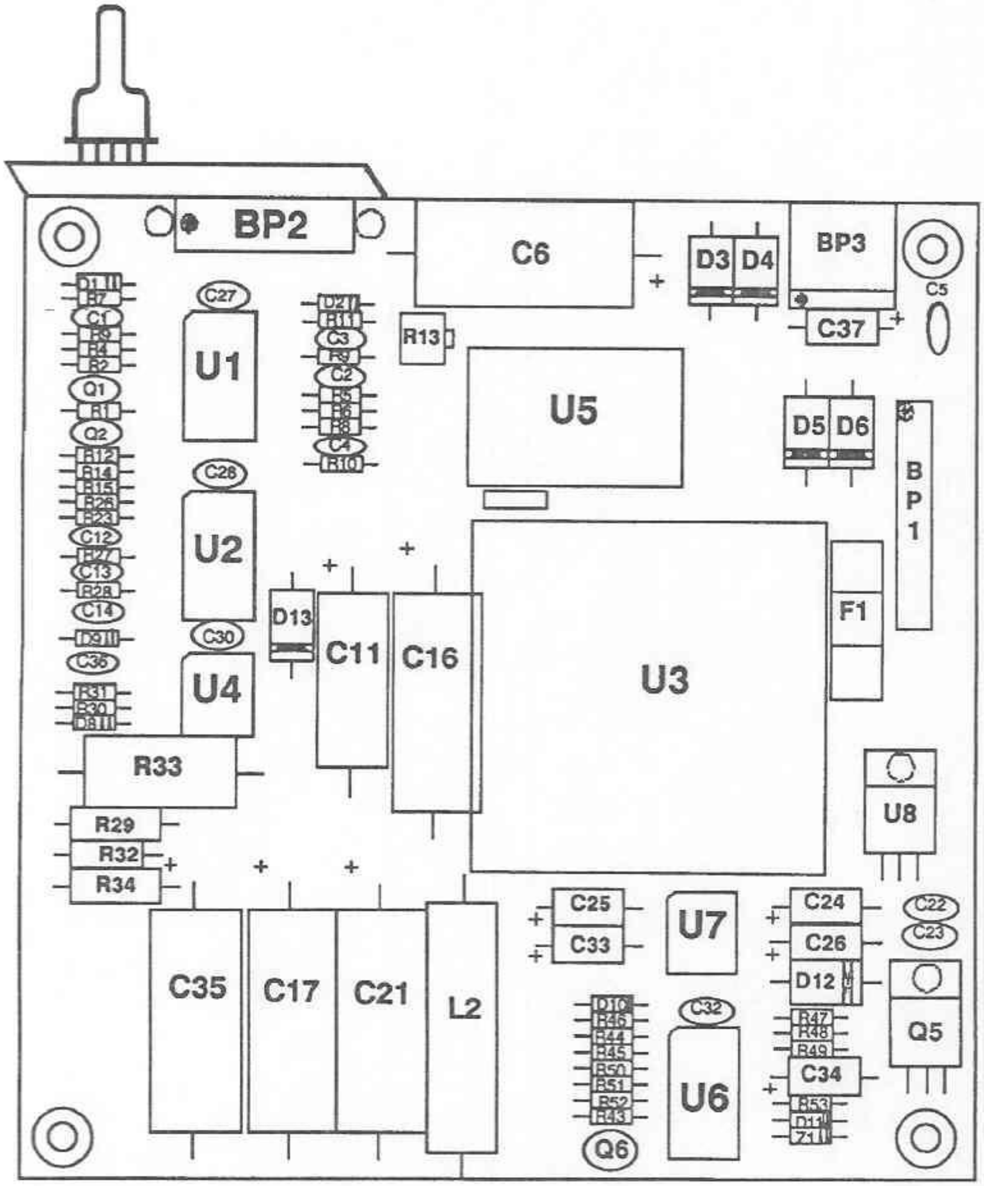

BP2
C6
D3
D4
BP3
C5
C37
D1
R7
C1
R9
R4
R2
Q1
R1
Q2
R12
R14
R15
R26
R23
C12
R27
C13
R28
C14
D9
C36
R31
R30
D8
C27
U1
D2
R11
C3
R3
C2
R5
R6
R8
C4
R10
R13
U5
D5
D6
B
P
1
C28
U2
C30
U4
D13
C11
C16
U3
F1
U8
R33
R29
R32
R34
C25
C33
U7
C24
C26
C22
C23
D12
Q5
C35
C17
C21
L2
D10
R46
R44
R45
R50
R51
R52
R43
Q6
C32
U6
R47
R48
R49
C34
R53
D11
Z1

Figure 4-12. Electrical power circuits.

(4) *Power regulator (-6 VDC).*

(a) This circuit consists of components U7-1, C25-1, and C26-1.

(b) The circuit input voltage is +6 VDC and the voltage output is -6 VDC.

(5) *Power detector (11 VDC to 30 VDC).*

(a) If input electrical power is lower than +11 VDC, pin 2 of U6-1 goes low and Q5-1 is turned on. SYSPWR which is connected to BATTPWR (in all modes of operation) will then power up the system through Q5-1, D12-1, U5-1, U7-1, and U8-1. At the same time, pin 14 of U6-1 is low which signals the microprocessor that external power is low. Pin 1 of U3-1 also goes low which turns off U4-1 (battery charging circuit).

(b) If input electrical power is higher than +11 VDC, pin 2 of U6-1 goes high which turns off Q5-1. (The control module is now operated by external electrical power.) At the same time, pin 14 of U6-1 is high which signals the microprocessor that external electrical power is good. Pin 1 of U16-1 is also high which turns on the battery charging circuit.

(c) If input electrical power is higher than +30 VDC, pin 13 of U6-1 goes low which signals the microprocessor that external electrical power is no good (too high).

4-29. Input circuits (fig 4-13).

a. Analog to digital converter (ADC). The ADC (U5-2) is read by the microcontroller U1-2 sequentially every 1 millisecond (first PRESSURE is read, next is RATEPOT, then INSPOT, and so on). The clock for the ADC is provided by frequency divider U9-2 and power is provided by the voltage reference circuit which comprises R12-1through R15-1, Q2-1, C37-1, and U2-1.

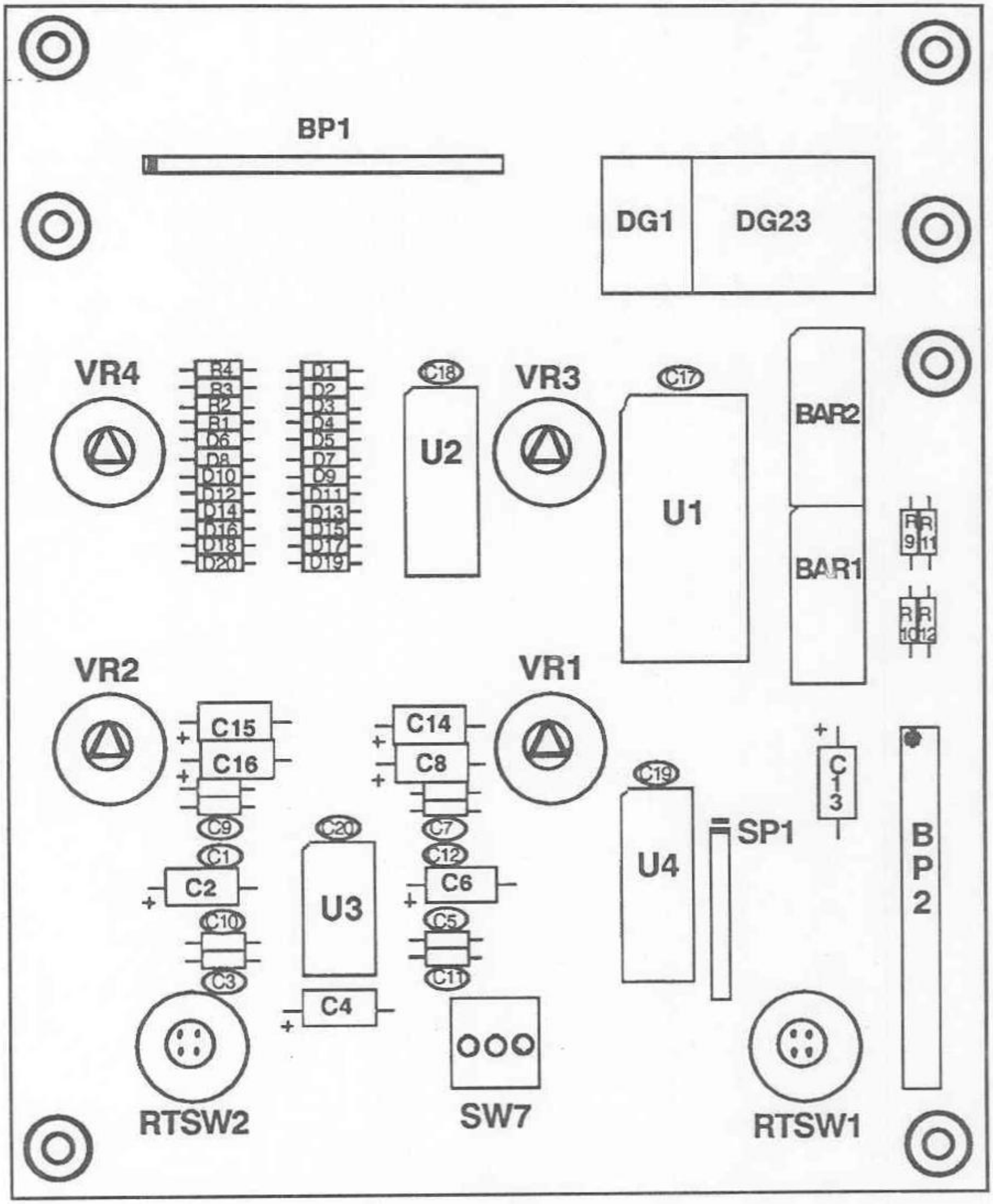

BP1
DG1
DG23
VR4
R4
R3
R2
R1
D6
D8
D10
D12
D14
D16
D18
D20
D1
D2
D3
D4
D5
D7
D9
D11
D13
D15
D17
D19
C18
U2
VR3
C17
U1
BAR2
BAR1
R 9
R 11
R 10
R 12
VR2
VR1
C15
C16
C14
C8
C9
C1
C2
C10
C3
C20
U3
C7
C12
C6
C5
C11
C4
C19
U4
SP1
C 1 3
B P 2
RTSW2
SW7
RTSW1

Figure 4-13. Input circuits.

(1) *Pressure*. The pressure signal is acquired through the transducer. The transducer receives its supply current from a constant current supply which consists of R1-1, R2-1, Q1-1, and 25 percent of U1-1 (pins 5, 6, and 7). The transducer signal is then amplified by a differential amplifier which consists of 75 percent of U1-1, R3-1 through R10-1, and C1-1 through C4-1. DC offset can be adjusted by R13-1. Before going to the ADC (U5-2), the signal is clipped to ground and +4.5 VDC by D1-1 and D2-1, and then filtered by R11-1 and C5-1.

(2) *Inspiration rate.* This signal is acquired through VR4-3 and buffered by U3-3 (pins 1, 2, and 3) before going to the ADC (U5-2).

(3) *Inspiration time.* This signal is acquired through VR3-3 and buffered by U3-3 (pins 5, 6, and 7) before going to the ADC (U5-2).

(4) *Low pressure alarm threshold*. This signal is acquired through VR2-3 and buffered by U3-3 (pins 8, 9, and 10) before going to the ADC (U5-2).

(5) *High pressure alarm threshold.* This signal is acquired through VR1-3 and buffered by U3-3 (pins 12, 13, and 14) before going to the ADC (U5-2).

(6) *Charger voltage*. The charger voltage signal is acquired from VCHGR (cathode of D8-1), divided by R22-2 and R23-3, and then buffered by U16-2 (pins 12, 13, and 14).

(7) *Battery voltage*. The battery voltage signal is acquired from BATTPWR, divided by R20-2 and R21-3, and then buffered by U12-2 (pins 12, 13, and 14).

b. Keyboard.

(1) *Dedicated input line.* The microcontroller (U1-2) reads the latch/buffer (U4-3) every 10 milliseconds to determine if any membrane switch has been depressed. Pull up is accomplished by SP1-3.

(2) *Matrix*. The microcontroller (U1-2) reads buffer (U2-3) every 10 milliseconds to determine if any key has been depressed. Pull up is by R1-3, R2-3, R3-3, and R4-3. D1-3, D2-3, D3-3, and D4-3 protect the output of U2-3, which is high, from shorting to ground if a key is depressed.

4-30. Processor circuits (fig 4-14).

a. Microcontroller. The microcontroller (U1-2) is an 8031. It runs at 6 MHz (C1-2, C2-2, and X1-2). A latch (U4-2) is needed because the lower address (bits 0-7) and data bus are multiplexed. This microcontroller has I/O ports (pins 1-8) that are used to control the audible alarm (DVOL1 and DVOL2), LED (LEDOUTCTL), main valve (GAS VALVE), and EEPROM read/write (pins 1-4). Peripheral devices are addressed by decoder (U7-2).

b. Reset circuit. The reset circuit includes R1-2, D3-2, C3-2, and U15-2. The microcontroller is reset when electrical power is turned on.

c. Watchdog circuit. The watchdog timer (U10-2) is probed by the microcontroller every 10-msec. If the microcontroller is ot operation, U10-2 will output a square wave which will reset the microcontroller, disable the main valve, and sound an alarm.

d. EEPROM. The EEPROM (U8-2) is used to store nonvolatile calibration pressure data.

e. Erasable programmable read-only memory (EPROM). The EPROM (U2-2) is used to store program information which is executed by the microcontroller (U1-2).

f. Random access memory (RAM). The RAM (U3-3) is used to store volatile data which is used by the microcontroller while the program is operating.

g. One-shot. The one-shot circuit consists of U15-2, U13-2, C6-2, C7-2, C8-2, R4-2, R5-2, D2-4, and U11-2. It is activated by the microcontroller through GASVALVEN1 and GASVALVEN2. The pulse width is 6.2 seconds which allows a maximum opening of the main valve for 6.2 seconds.

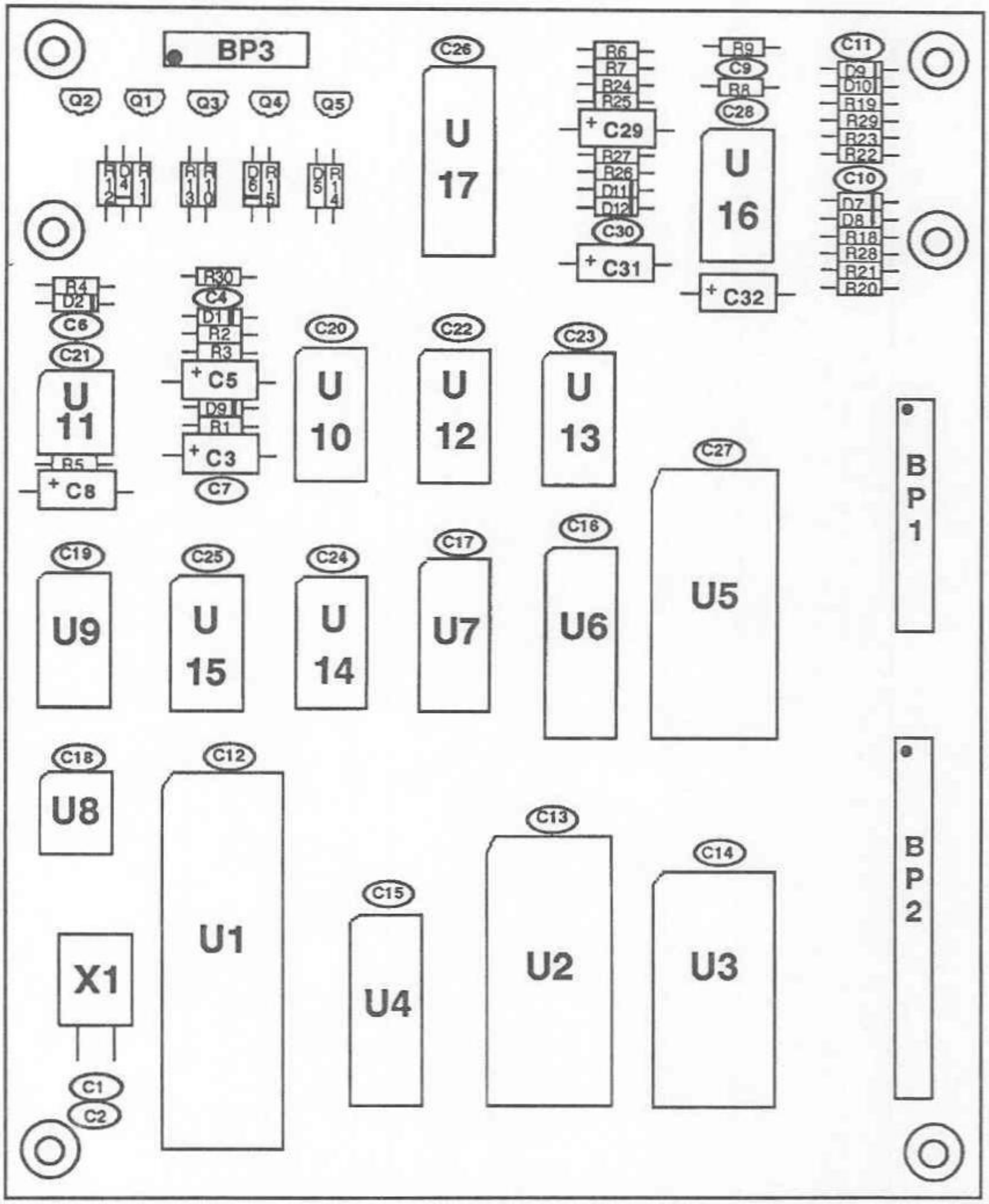

BP3
C26
R6
R7
R24
R25
R9
C9
R8
C28
C11
D9
D10
R19
R29
R23
R22
Q2
Q1
Q3
Q4
Q5
U 17
C29
R27
R26
D11
D12
C30
C31
U 16
C32
C10
D7
D8
R18
R28
R21
R20
R12
D4
R11
R13
R10
D6
R15
D5
R14
R4
D2
R30
C4
D1
R2
R3
C5
D9
R1
C3
C7
C6
C21
U 11
R5
C8
C20
U 10
C22
U 12
C23
U 13
C27
U5
BP1
C19
U9
C25
U 15
C24
U 14
C17
U7
C16
U6
C18
U8
C12
U1
C13
U2
C14
U3
C15
U4
BP2
X1
C1
C2

Figure 4-14. Processor circuits.

4-31. Output circuits.

a. Main valve. The operation of the main valve is controlled by microcontroller (U1-2) through buffer (U17-2), Q1-5, and Q2-5. It is disabled when the watchdog timer is pulsing (microcontroller is not operating). It is open continuously when VALVE1 (TRGSW) is depressed (grounded).

b. Demand valve. The operation of the demand valve is controlled by microcontroller (U1-2) through buffer (U6-2), U17-2, and Q5-2.

c. Segment display. The 7-segment display is operated by the microcontroller to display numbers and limited characters on DG1-3 and DG23-3. The 7-segment display is driven by the 8-bit LED multiplexed display driver (U1-3).

d. Bar graph display. The bar graph display is operated by the microcontroller to display bar graph segments on BAR 1-3 and BAR 2-3. The bar graph display is driven by the 8-bit multiplexed display driver (U1-3).

e. LED displays. LED illumination is controlled by the microcontroller. LEDs are driven by the 8-bit multiplexed display driver (U1-3).

Section XI. STORAGE AND SHIPMENT PROCEDURES

4-32. Preparation for storage.

This section contains the procedures for preparing the ventilator for storage.

a. Shut down the ventilator by following the procedures in paragraph 2-26.

b. Remove all interconnecting hoses and electrical connectors.

c. Clean the ventilator and operating accessories by following the procedures in chapter 2, section XI.

NOTE

It is not necessary to sterilize operating accessories prior to storage.

d. Perform the PMCS. (Refer to chap 4, sec IV.)

e. Replace all missing or unserviceable accessories.

f. Initiate corrective maintenance, if required.

g. Ensure that the battery pack is fully charged or charge the battery pack by following the procedures in paragraph 4-14.

h. Open the case and repack all operating accessories, the multivoltage power supply, the vehicle electrical power supply, and the manufacturer manuals (2).

i. Repack the control module.

j. Close the case and fasten the two pressure-lock latches.

CAUTION

Do not store the ventilator with the battery pack discharged to prevent premature failure of the batteries.

The optimum storage temperature range is 10°C (50°F) to 30°C (86°F). However, short-term storage temperatures may range between 15°C (59°F) and 40°C (104°F).

4-33. Battery pack recharge intervals.

Battery pack recharge intervals for various storage temperature ranges are provided in table 4-3.

Table 4-3. Battery pack recharge intervals.

Storage temperature range	Recharge interval
Below 20°C (68°F)	18 months
20°C (68°F) to 30°C (86°F)	12 months
30°C (86°F) to 40°C (104°F)	6 months

4-34. Preparation for shipment.

This section contains the instructions for preparing the ventilator for shipment as an individual item of equipment.

NOTE

> No additional preparation for shipment is required when packed into an ISO shelter or other bulk shipping container providing physical and environmental protection.

a. Place the ventilator in an appropriate cardboard carton.

b. Transfer the ventilator to the unit transportation point for crating and shipping.

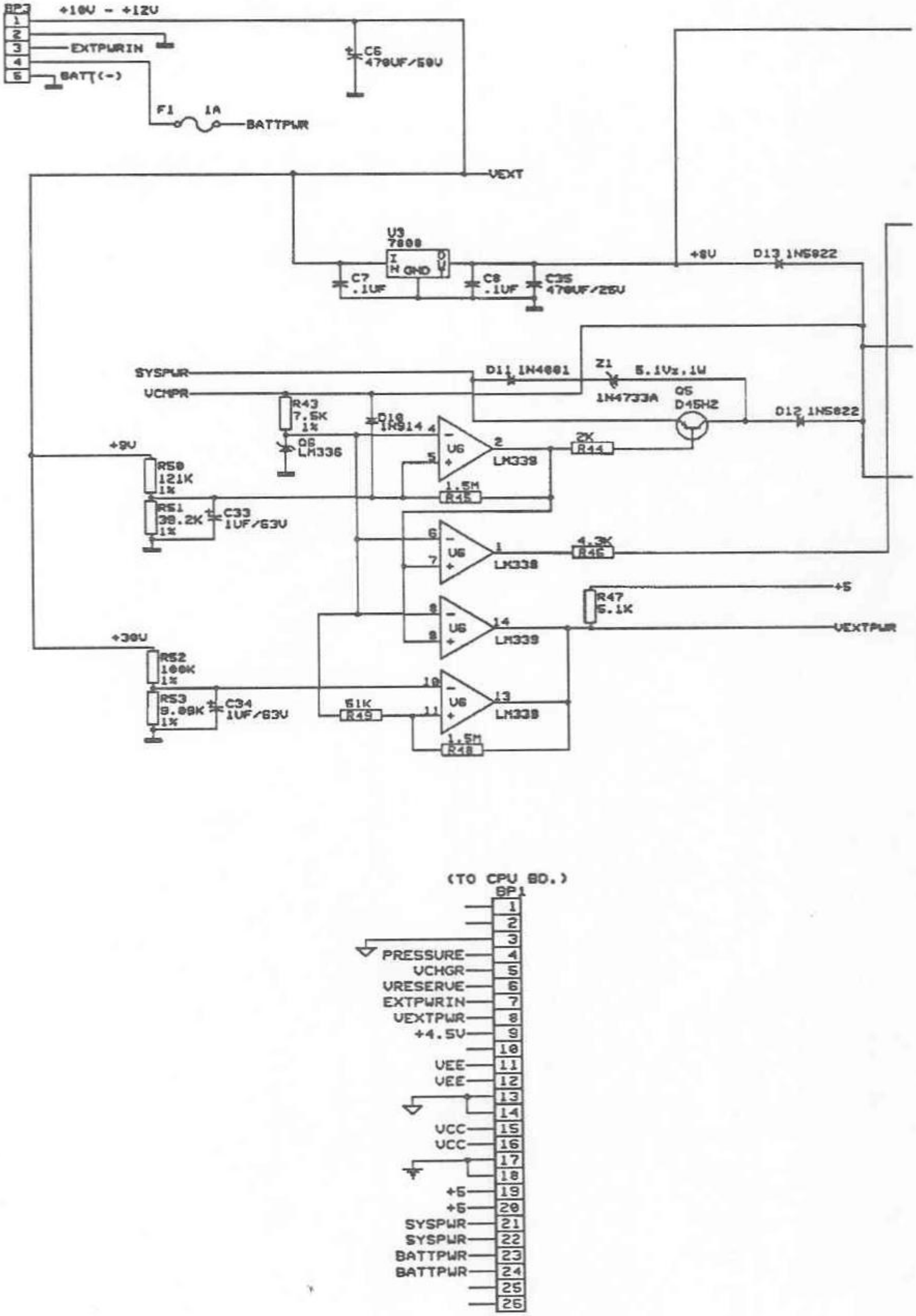

BP3
+10V - +12V
1
2
3
4
5
EXTPWRIN
BATT(-)
F1
1A
BATTPWR
C6
470UF/50V
VEXT
U3
7808
I
N
GND
O
U
T
C7
.1UF
C8
.1UF
C35
470UF/25V
+8V
D13 1N5822
SYSPWR
VCMPR
D11 1N4001
Z1
5.1Vz,1W
1N4733A
Q5
D45H2
D12 1N5822
R43
7.5K
1%
D10
1N914
Q8
LM336
4
5
2
U6
LM339
2K
R44
1.5M
R45
+9V
R50
121K
1%
R51
38.2K
1%
C33
1UF/63V
6
7
1
U6
LM339
4.3K
R46
R47
5.1K
+5
8
9
14
U6
LM339
VEXTPWR
+30V
R52
100K
1%
R53
9.09K
1%
C34
1UF/63V
10
11
13
U6
LM339
51K
R49
1.5M
R48
(TO CPU BD.)
BP1
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
PRESSURE
VCHGR
VRESERVE
EXTPWRIN
VEXTPWR
+4.5V
VEE
VEE
VCC
VCC
+5
+5
SYSPWR
SYSPWR
BATTPWR
BATTPWR

Figure 4-15. Wiring diagram No. 1.

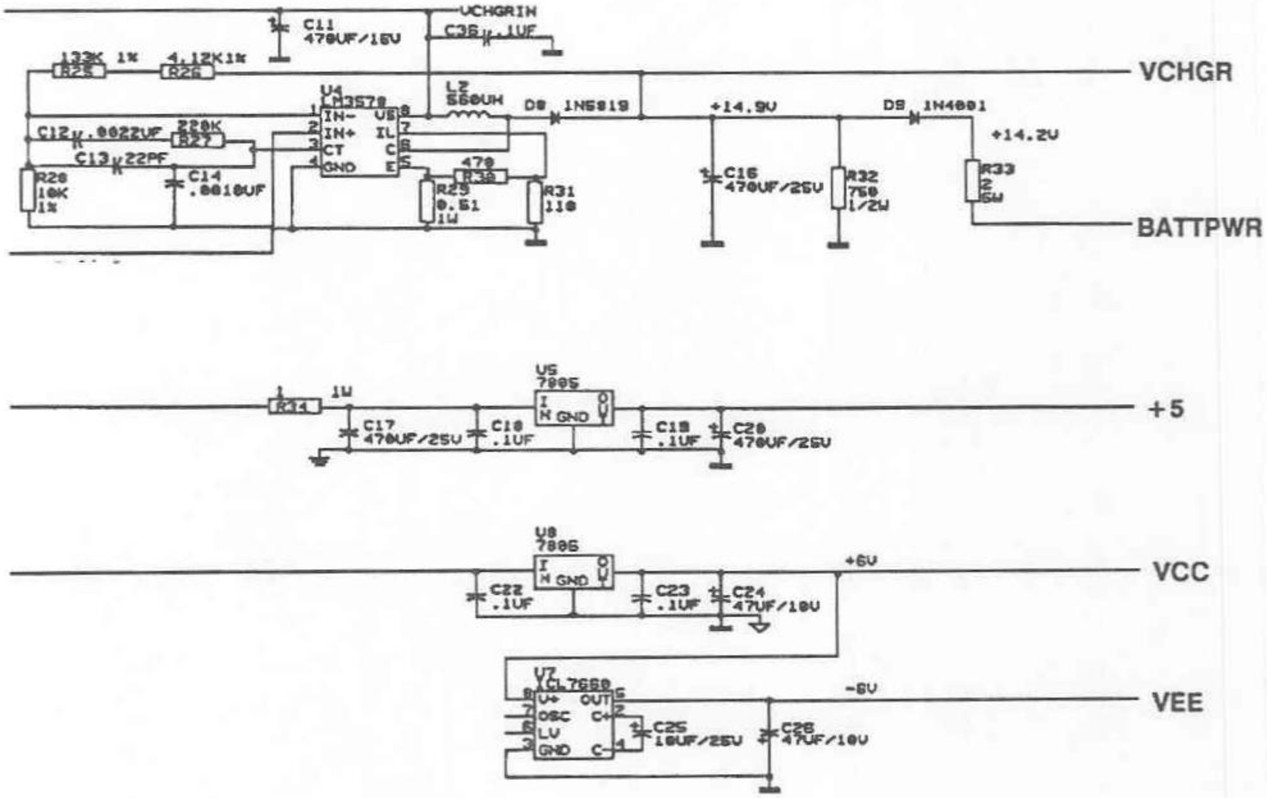
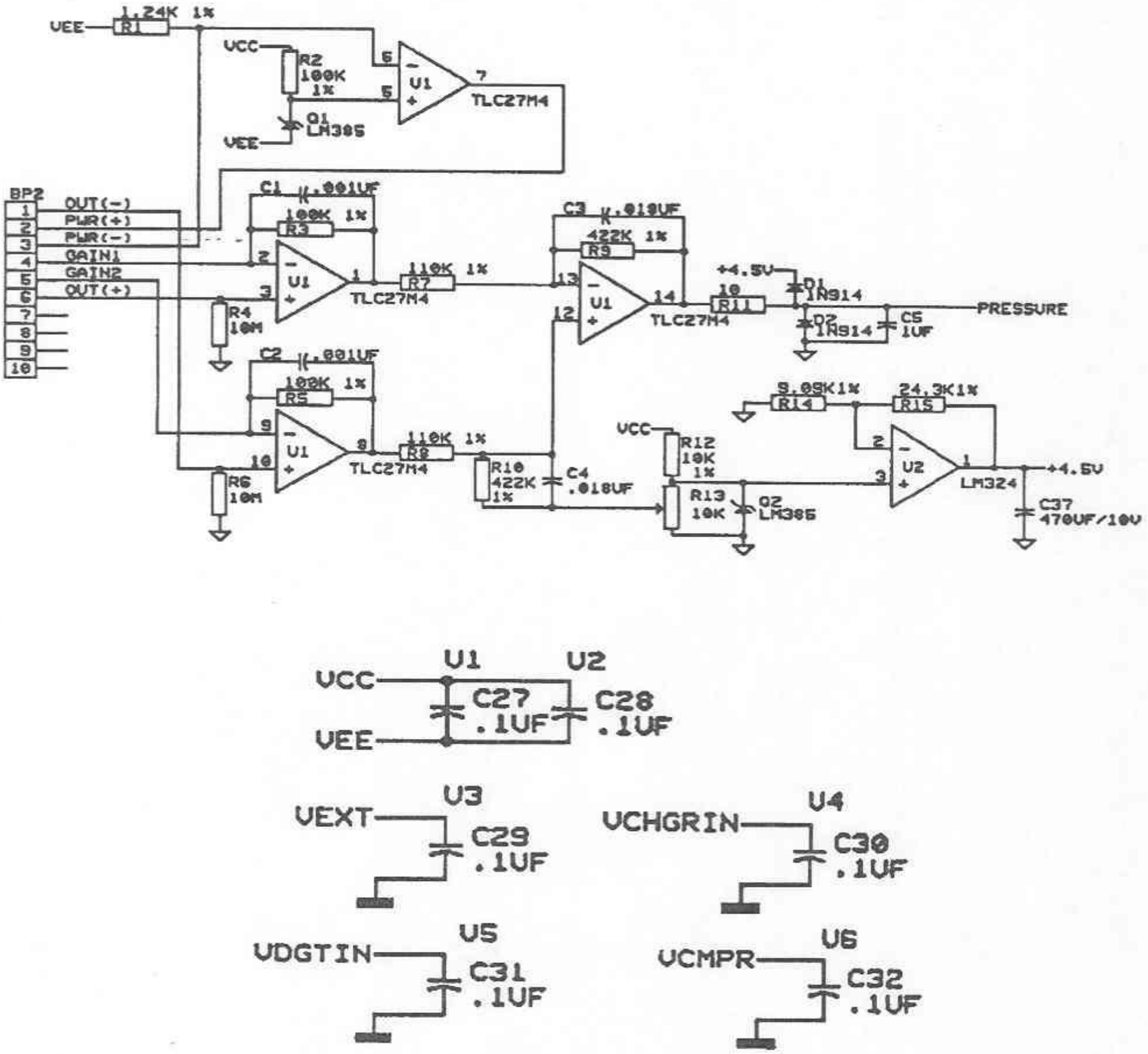

VCHGRIN
C11
470UF/16V
C36 .1UF
133K 1%
R25
4.12K1%
R26
VCHGR
U4
LM3578
1 IN-
2 IN+
3 CT
4 GND
8 VS
7 IL
6 C
5 E
L2
560UH
D8 1N5819
+14.9V
D9 1N4001
+14.2V
C12 .0022UF
220K
R27
C13 22PF
C14
.0010UF
R28
10K
1%
470
R30
R29
0.51
1W
R31
110
C16
470UF/25V
R32
750
1/2W
R33
2
5W
BATTPWR
U5
7805
1
R34
1W
I N
GND
O U
C17
470UF/25V
C10
.1UF
C19
.1UF
C20
470UF/25V
+5
U8
7806
+6V
C22
.1UF
C23
.1UF
C24
47UF/10V
VCC
U7
ICL7660
8 V+
7 OSC
6 LV
3 GND
5 OUT
2 C+
4 C-
-6V
C25
10UF/25V
C26
47UF/10V
VEE

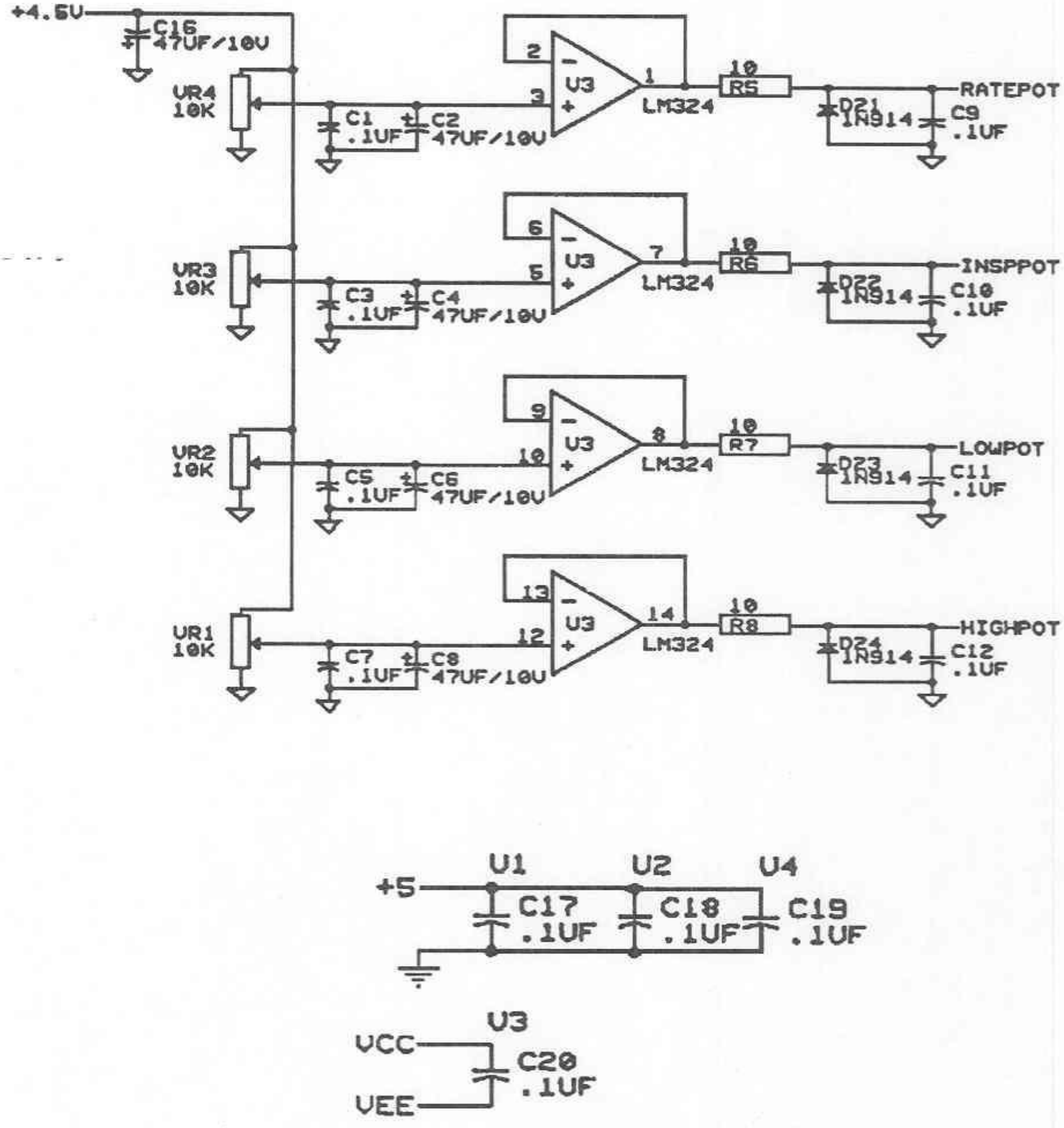
Figure 4-15 Wiring diagram No. 1 (continued).


VEE
R1
1.24K 1%
VCC
R2
100K
1%
Q1
LM385
VEE
U1
TLC27M4
6
5
7
BP2
1
2
3
4
5
6
7
8
9
10
OUT(-)
PWR(+)
PWR(-)
GAIN1
GAIN2
OUT(+)
C1 .001UF
100K 1%
R3
2
3
1
U1
TLC27M4
R4
10M
110K 1%
R7
C3 .010UF
422K 1%
R9
13
12
14
U1
TLC27M4
+4.5V
D1
1N914
10
R11
D2
1N914
C5
1UF
PRESSURE
C2 .001UF
100K 1%
R5
9
10
8
U1
TLC27M4
R6
10M
110K 1%
R8
R10
422K
1%
C4
.010UF
VCC
R12
10K
1%
R13
10K
Q2
LM385
9.09K1%
R14
24.3K1%
R15
2
3
1
U2
LM324
+4.5V
C37
470UF/10V
U1
U2
VCC
VEE
C27
.1UF
C28
.1UF
VEXT
U3
C29
.1UF
VCHGRIN
U4
C30
.1UF
VDGTIN
U5
C31
.1UF
VCMPR
U6
C32
.1UF

BYPASS CAP. WIRING

PIN ASSIGNMENT	REFD DES						
	VCC	VEE	VEXT	VCHGRIN	VDGTIN	VCMPR	PAGND
U1, U2	4	11					
U3			8				4
U4				8			4
U5					8		4
U6						3	12

Figure 4-16. Wiring diagram No. 2.


+4.5V
C16
47UF/10V
VR4
10K
C1
.1UF
C2
47UF/10V
2
3
U3
1
LM324
10
R5
D21
1N914
C9
.1UF
RATEPOT
VR3
10K
C3
.1UF
C4
47UF/10V
6
5
U3
7
LM324
10
R6
D22
1N914
C10
.1UF
INSPPOT
VR2
10K
C5
.1UF
C6
47UF/10V
9
10
U3
8
LM324
10
R7
D23
1N914
C11
.1UF
LOWPOT
VR1
10K
C7
.1UF
C8
47UF/10V
13
12
U3
14
LM324
10
R8
D24
1N914
C12
.1UF
HIGHPOT
U1
U2
U4
+5
C17
.1UF
C18
.1UF
C19
.1UF
U3
VCC
VEE
C20
.1UF

BYPASS CAP. WIRING

PIN ASSIGNMENT	REF DES			
	+5	GND	VCC	VEE
U1	19	28		
U2, U4	20	10		
U3			4	11

Figure 4-17. Wiring diagram No. 3.

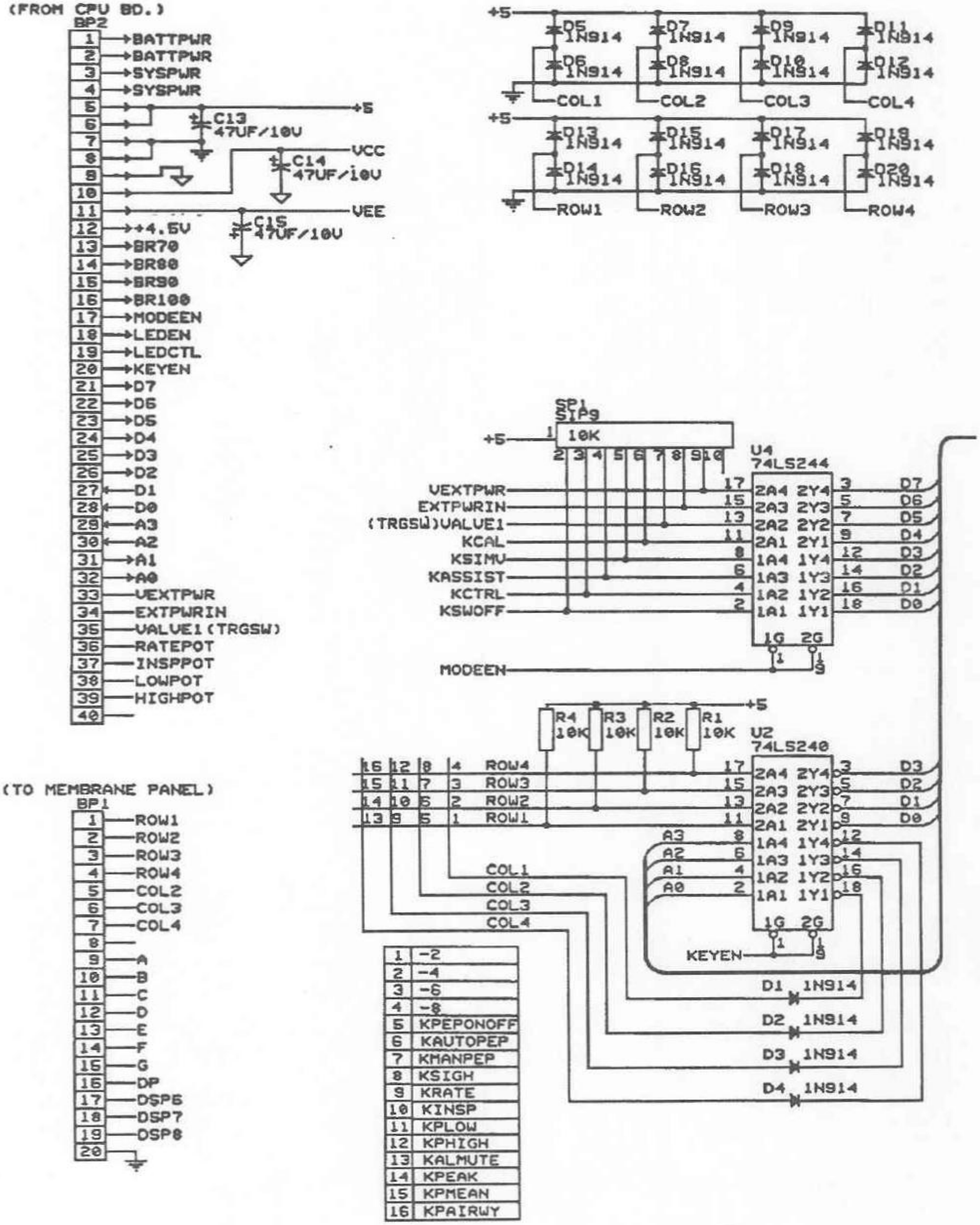

(FROM CPU BD.)
BP2
1 BATTPWR
2 BATTPWR
3 SYSPWR
4 SYSPWR
5
6
7
8
9
10
11
12 +4.5V
13 BR70
14 BR80
15 BR90
16 BR100
17 MODEEN
18 LEDEN
19 LEDCTL
20 KEYEN
21 D7
22 D6
23 D5
24 D4
25 D3
26 D2
27 D1
28 D0
29 A3
30 A2
31 A1
32 A0
33 VEXTPWR
34 EXTPWRIN
35 VALVE1 (TRGSW)
36 RATEPOT
37 INSPPOT
38 LOWPOT
39 HIGHPOT
40
+5
C13 47UF/10V
VCC
C14 47UF/10V
VEE
C15 47UF/10V
+5
D5 1N914
D6 1N914
D7 1N914
D8 1N914
D9 1N914
D10 1N914
D11 1N914
D12 1N914
COL1
COL2
COL3
COL4
+5
D13 1N914
D14 1N914
D15 1N914
D16 1N914
D17 1N914
D18 1N914
D19 1N914
D20 1N914
ROW1
ROW2
ROW3
ROW4
SP1
SIP9
+5
1
10K
2 3 4 5 6 7 8 9 10
U4
74LS244
VEXTPWR
EXTPWRIN
(TRGSW)VALVE1
KCAL
KSIMV
KASSIST
KCTRL
KSWOFF
17 2A4 2Y4 3 D7
15 2A3 2Y3 5 D6
13 2A2 2Y2 7 D5
11 2A1 2Y1 9 D4
8 1A4 1Y4 12 D3
6 1A3 1Y3 14 D2
4 1A2 1Y2 16 D1
2 1A1 1Y1 18 D0
1G 2G
1 19
MODEEN
+5
R4 10K
R3 10K
R2 10K
R1 10K
U2
74LS240
16 12 8 4 ROW4
15 11 7 3 ROW3
14 10 6 2 ROW2
13 9 5 1 ROW1
17 2A4 2Y4 3 D3
15 2A3 2Y3 5 D2
13 2A2 2Y2 7 D1
11 2A1 2Y1 9 D0
A3 8 1A4 1Y4 12
A2 6 1A3 1Y3 14
A1 4 1A2 1Y2 16
A0 2 1A1 1Y1 18
COL1
COL2
COL3
COL4
1G 2G
1 19
KEYEN
D1 1N914
D2 1N914
D3 1N914
D4 1N914
1 -2
2 -4
3 -6
4 -8
5 KPEPONOFF
6 KAUTOPEP
7 KMANPEP
8 KSIGH
9 KRATE
10 KINSP
11 KPLOW
12 KPHIGH
13 KALMUTE
14 KPEAK
15 KPMEAN
16 KPAIRWY
(TO MEMBRANE PANEL)
BP1
1 ROW1
2 ROW2
3 ROW3
4 ROW4
5 COL2
6 COL3
7 COL4
8
9 A
10 B
11 C
12 D
13 E
14 F
15 G
16 DP
17 DSP6
18 DSP7
19 DSP8
20

Figure 4-18. Wiring diagram No. 4.

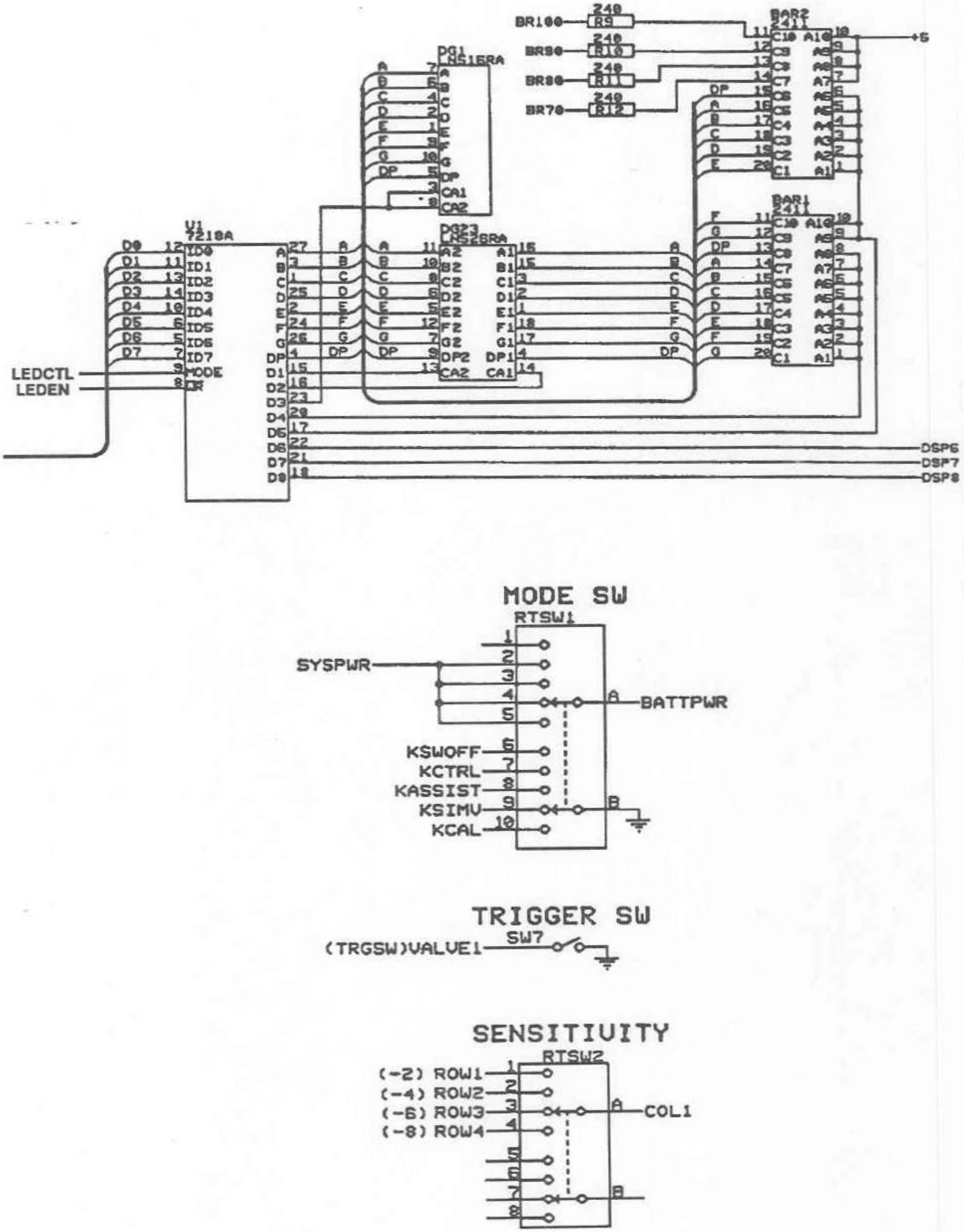

BR100
BR90
BR80
BR70
240
R9
R10
R11
R12
BAR2
2411
+5
DG1
LN516RA
DG23
LN526RA
BAR1
2411
U1
7218A
D0
D1
D2
D3
D4
D5
D6
D7
LEDCTL
LEDEN
MODE
DSP6
DSP7
DSP8
MODE SW
RTSW1
SYSPWR
BATTPWR
KSWOFF
KCTRL
KASSIST
KSIMV
KCAL
TRIGGER SW
(TRGSW)VALVE1
SW7
SENSITIVITY
RTSW2
(-2) ROW1
(-4) ROW2
(-6) ROW3
(-8) ROW4
COL1

Figure 4-18. Wiring diagram No. 4 (continued).

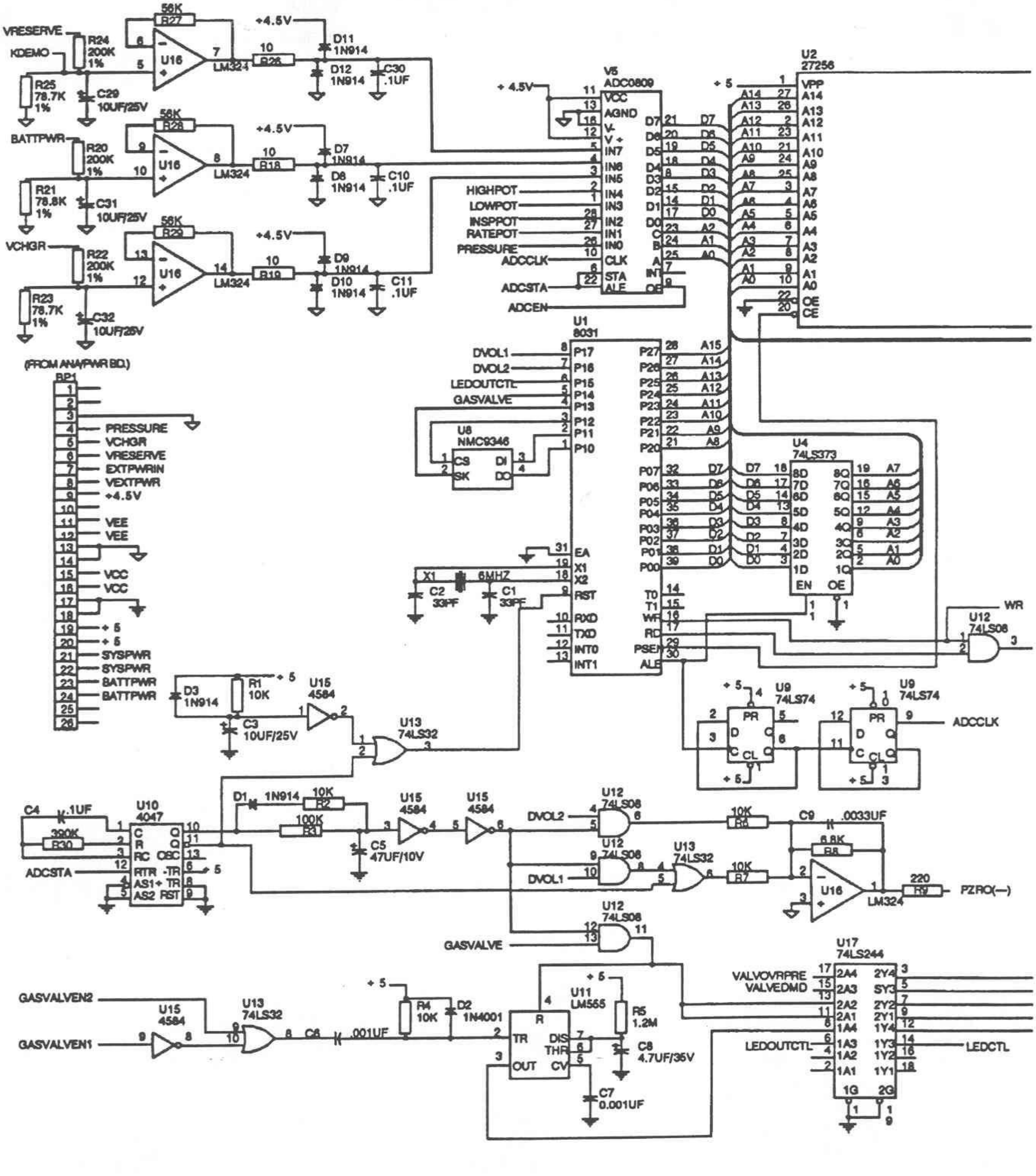
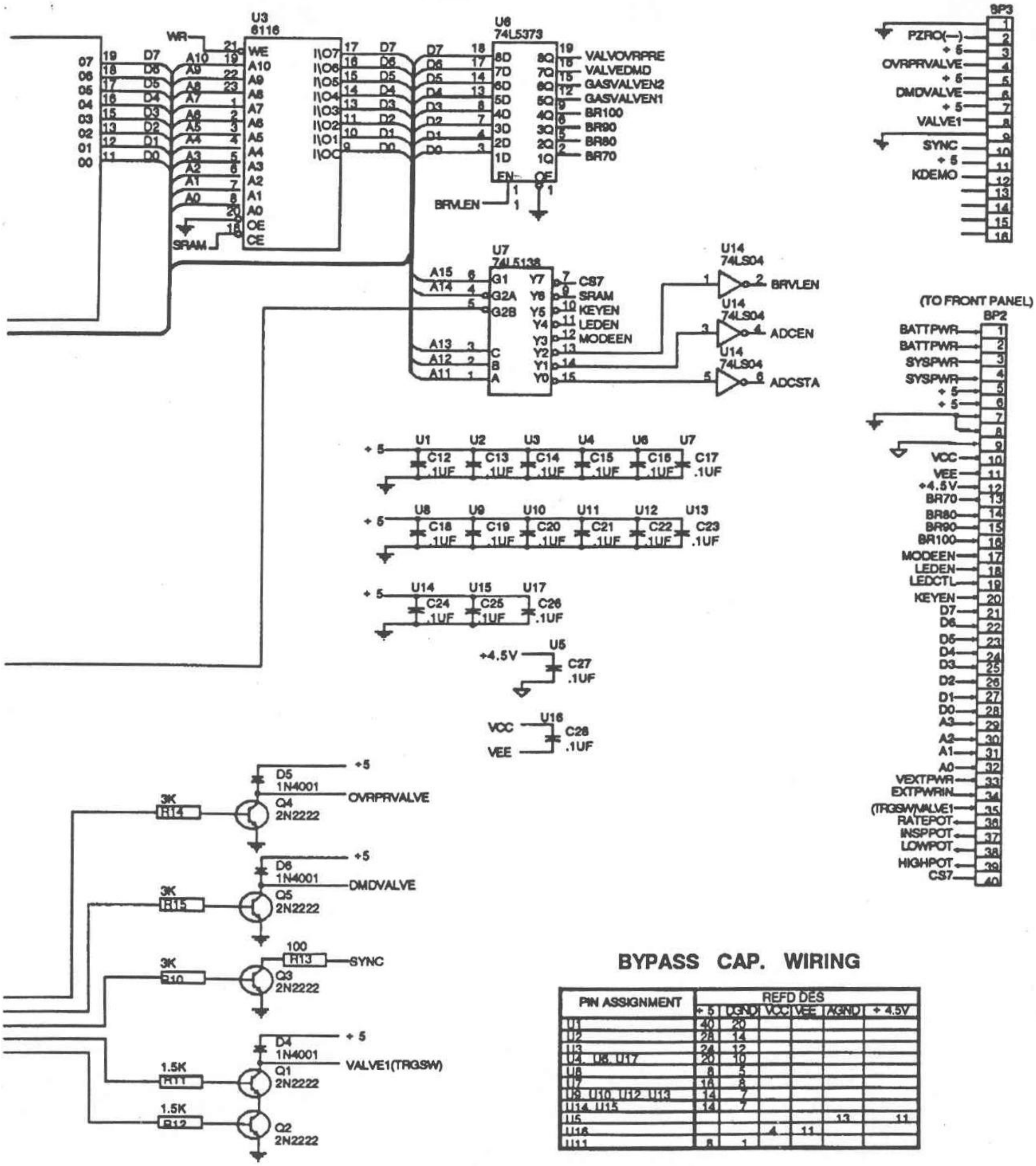

VRESERVE
KDEMO
R24 200K 1%
R25 78.7K 1%
C29 10UF/25V
56K R27
U16 LM324
10 R26
+4.5V
D11 1N914
D12 1N914
C30 .1UF
BATTPWR
R20 200K 1%
R21 78.8K 1%
C31 10UF/25V
56K R28
10 R18
D7 1N914
D8 1N914
C10 .1UF
VCHGR
R22 200K 1%
R23 78.7K 1%
C32 10UF/25V
56K R29
10 R19
D9 1N914
D10 1N914
C11 .1UF
+4.5V
V5 ADC0809
VCC
AGND
V-
V+
IN7
IN6
IN5
IN4
IN3
IN2
IN1
IN0
CLK
STA
ALE
INT
OE
HIGHPOT
LOWPOT
INSPPOT
RATEPOT
PRESSURE
ADCCLK
ADCSTA
ADCEN
+5
U2 27256
VPP
A14
A13
A12
A11
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
OE
CE
U1 8031
DVOL1
DVOL2
LEDOUTCTL
GASVALVE
P17
P16
P15
P14
P13
P12
P11
P10
P27
P26
P25
P24
P23
P22
P21
P20
P07
P06
P05
P04
P03
P02
P01
P00
EA
X1
X2
RST
RXD
TXD
INT0
INT1
T0
T1
WR
RD
PSEN
ALE
U8 NMC9346
CS
SK
DI
DO
X1 6MHZ
C2 33PF
C1 33PF
U4 74LS373
8D 7D 6D 5D 4D 3D 2D 1D
8Q 7Q 6Q 5Q 4Q 3Q 2Q 1Q
EN
OE
WR
U12 74LS08
(FROM ANA/PWR BD.)
BP1
PRESSURE
VCHGR
VRESERVE
EXTPWRIN
VEXTPWR
+4.5V
VEE
VEE
VCC
VCC
+5
+5
SYSPWR
SYSPWR
BATTPWR
BATTPWR
D3 1N914
R1 10K
C3 10UF/25V
U15 4584
U13 74LS32
U9 74LS74
PR
CL
ADCCLK
C4 .1UF
390K R30
U10 4047
C
R
RC
RTR
AS1
AS2
OSC
-TR
+TR
RST
ADCSTA
D1 1N914
10K R2
100K R3
C5 47UF/10V
DVOL2
DVOL1
10K R6
C9 .0033UF
6.8K R8
10K R7
220 R9
PZRO(—)
GASVALVE
U17 74LS244
VALVOVRPRE
VALVEDMD
LEDOUTCTL
LEDCTL
2A4 2A3 2A2 2A1 1A4 1A3 1A2 1A1
2Y4 SY3 2Y2 2Y1 1Y4 1Y3 1Y2 1Y1
1G 2G
GASVALVEN2
GASVALVEN1
C6 .001UF
R4 10K
D2 1N4001
U11 LM555
TR
OUT
DIS
THR
CV
R5 1.2M
C8 4.7UF/35V
C7 0.001UF

Figure 4-19. Wiring diagram No. 5.


U3
6116
WR
WE
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
OE
CE
SRAM
I\O7
I\O6
I\O5
I\O4
I\O3
I\O2
I\O1
I\O0
07
06
05
04
03
02
01
00
D7
D6
D5
D4
D3
D2
D1
D0
U6
74LS373
8D
7D
6D
5D
4D
3D
2D
1D
8Q
7Q
6Q
5Q
4Q
3Q
2Q
1Q
EN
OE
BRVLEN
VALVOVRPRE
VALVEDMD
GASVALVEN2
GASVALVEN1
BR100
BR90
BR80
BR70
U7
74LS138
A15
A14
A13
A12
A11
G1
G2A
G2B
C
B
A
Y7
Y6
Y5
Y4
Y3
Y2
Y1
Y0
CS7
SRAM
KEYEN
LEDEN
MODEEN
U14
74LS04
BRVLEN
ADCEN
ADCSTA
SP3
PZRO(—)
+ 5
OVRPRVALVE
+ 5
DMDVALVE
+ 5
VALVE1
SYNC
+ 5
KDEMO
(TO FRONT PANEL)
BP2
BATTPWR
BATTPWR
SYSPWR
SYSPWR
+ 5
+ 5
VCC
VEE
+4.5V
BR70
BR80
BR90
BR100
MODEEN
LEDEN
LEDCTL
KEYEN
D7
D6
D5
D4
D3
D2
D1
D0
A3
A2
A1
A0
VEXTPWR
EXTPWRIN
(TRGSW)VALVE1
RATEPOT
INSPPOT
LOWPOT
HIGHPOT
CS7
+ 5
U1 U2 U3 U4 U6 U7
C12 .1UF
C13 .1UF
C14 .1UF
C15 .1UF
C16 .1UF
C17 .1UF
U8 U9 U10 U11 U12 U13
C18 .1UF
C19 .1UF
C20 .1UF
C21 .1UF
C22 .1UF
C23 .1UF
U14 U15 U17
C24 .1UF
C25 .1UF
C26 .1UF
+4.5V
U5
C27 .1UF
VCC
VEE
U16
C28 .1UF
+5
D5 1N4001
OVRPRVALVE
3K R14
Q4 2N2222
+5
D6 1N4001
DMDVALVE
3K R15
Q5 2N2222
100 R13
SYNC
3K R10
Q3 2N2222
+ 5
D4 1N4001
VALVE1(TRGSW)
1.5K R11
Q1 2N2222
1.5K R12
Q2 2N2222

BYPASS CAP. WIRING

PIN ASSIGNMENT	REFD DES					
	+ 5	DGND	VCC	VEE	AGND	+ 4.5V
U1	40	20				
U2	28	14				
U3	24	12				
U4, U6, U17	20	10				
U8	8	5				
U7	16	8				
U9, U10, U12, U13	14	7				
U14, U15	14	7				
U5					13	11
U16			4	11		
U11	8	1				

Figure 4-19. Wiring diagram No. 5 (continued).

CHAPTER 5

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE

Section I. GENERAL INFORMATION

5-1. Overview.

This chapter provides for maintenance that is beyond the capability, capacity, and authorization for unit level maintenance personnel. The procedures in this chapter should not be attempted at the unit level.

5-2. Tools and test equipment.

Common tools and test equipment required for support maintenance of the equipment are listed in appendix B, section III. Refer to your unit's MTOE or installation table of distribution and allowances (TDA) for authorized items.

5-3. Components of end item and basic issue items.

Components of end item and basic issue items are listed in appendix C, sections II and III.

5-4. Expendable supplies.

Expendable and durable supplies and materials for support maintenance are listed in appendix D, section II.

5-5. Repair parts.

Repair parts required for support maintenance are listed in appendix E, section II.

5-6. Special tools.

Special tools required for support maintenance are listed in appendix E, section III.

5-7. Additional authorization list items.

Additional items required for augmented ventilation modes are identified in appendix F, section II of this manual.

5-8. Support maintenance services.

Specific procedures and instructions for support maintenance services are not currently available.

Section II. TROUBLESHOOTING

5-9. General.

Specific troubleshooting procedures for the control module and blender are not currently available.

APPENDIX A

REFERENCES

A-1. Army regulations.

AR 40-61	Medical Logistics Policies and Procedures
AR 710-2	Supply Policy Below the Wholesale Level
AR 725-50	Requisitioning, Receipt, and Issue System

A-2. Technical manuals.

TM-DPSC-6500-RPL	Medical Materiel: Medical Repair Parts Reference List
TM 8-6520-003-24&P	Compressor-Dehydrator, Dental, Model M5B (Serial Numbers 2700 and Above), 6520-00-139-1246

A-3. Technical bulletins.

TB MED 7	Maintenance Expenditure Limits for Medical Materiel
TB 8-6500-MPL	Mandatory Parts List for Medical Equipment
TB 38-750-2	Maintenance Management Procedures for Medical Equipment
TB 740-10/DLAM 4155.5/AFR 67-43	Quality Control, Depot Storage Standards, Appendix M, Medical Supplies

A-4. Field manual.

FM 21-11	First Aid for Soldiers

A-5. Supply bulletin.

SB 8-75-( )-series	Army Medical Department Supply Information

A-6. Other publications.

(These publications may be obtained from Commander, U.S. Army Medical Materiel Agency, ATTN: SGMMA-M, Frederick, MD 21702-5001.)

Instruction Manual, Operation and Service, Portable Ventilator, Models 750 and 750M, (Rev A/09-90), Impact Instrumentation, Inc.

Instruction Manual, Operation and Service, Air-Oxygen Mixer, Model 751, (REV 0 (08/90)), Impact Instrumentation, Inc.

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General.

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance levels.

c. Section III lists the tools and test equipment required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions, explanatory notes, and/or illustrations required for a particular maintenance function.

B-2. Explanation of columns in section II.

a. Group Number, Column 1. The assembly group number (Group No.) column is a numerical group assigned to each assembly. The applicable assembly groups are listed in the maintenance allocation chart (MAC) in disassembly sequence beginning with the first assembly removed in a top down disassembly sequence.

b. Assembly Group, Column 2. This column contains a brief description of the components of each assembly group.

c. Maintenance Functions, Column 3. This column lists the various maintenance functions (A through K) and indicates the lowest maintenance level authorized to perform these functions. The symbol designations for the various maintenance levels are as follows:

C - Operator or crew
O - Unit maintenance
F - Direct support maintenance
H - General support maintenance
D - Depot maintenance

The maintenance functions are defined as follows:

A - Inspect. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

B - Test. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C - Service. To clean, to preserve, to charge, and to add lubricants, cooling agents, and air. If it is desired that elements, such as painting and lubricating, be defined separately, they may be so listed.

D - Adjust. To rectify to the extent necessary to bring into proper operating range.

E - Align. To adjust specified variable elements of an item to bring it to optimum performance.

F - Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G - Install. To set for use in an operational environment such as tents or International Standards Organization shelters.

H - Replace. To replace unserviceable items with serviceable like items.

I - Repair. Those maintenance operations necessary to restore an item to serviceable condition through correction of material damage to a specific failure. Repair may be accomplished at each level of maintenance.

J - Overhaul. Normally the highest degree of maintenance performed by the Army in order to minimize time work in process consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by a maintenance standard in technical publications for each item of equipment. Overhaul normally does not return an item to like new condition.

K - Rebuild. The highest degree of material maintenance. It consists of restoring equipment as nearly as possible to new condition in accordance with original manufacturing standards. Rebuild is performed only when required by operational considerations or other paramount factors and then only at the depot maintenance level.

d. Tools and Equipment, Column 4. This column is provided for referencing by code, the tools and test equipment (sec III) required to perform the maintenance functions.

e. Remarks, Column 5. This column is provided for referencing by code, the remarks (sec IV) pertinent to the maintenance functions.

B-3. Explanation of columns in section III.

a. Reference Code, Column 1. This column correlates to section II, column 4.

b. Maintenance Level, Column 2. This column identifies the maintenance levels using the tools and test equipment.

c. Nomenclature, Column 3. This column identifies the tools and test equipment.

d. National Stock Number, Column 4. This column provides the national stock number of the specific tools or test equipment.

B-4. Explanation of columns in section IV.

a. Reference Code, Column 1. This column correlates to section II, column 5.

b. Remarks, Column 2. This column provides supplemental information or explanatory notes pertinent to the maintenance function in section II.

Section II. MAINTENANCE ALLOCATION CHART FOR VENTILATOR

(1) GROUP NO.	(2) ASSEMBLY GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
00	Ventilator	O 0.6	O 1.1	O 0.8			O 1.6		O 0.4	O 2.2	F 6.3	D 14.2	01,02,03, 04,05,06, 07,08,09, 10,11	A, B
01	Control Module												01,02,03, 04,05,06, 07,08,09, 10,11	A, B
	Battery Pack		O 0.3	O 0.3					O 0.4					
	Battery Compartment Door	O 0.1				O 0.3			O 0.5					
	Cover	O 0.1		O 0.3		O 0.3			O 0.5					
	Case, Lower	O 0.1		O 0.3					O 0.8	O 0.3				
	Linear Regulators PCB		F 0.8						O 0.6	F 0.8				
	Analog/Power Supply PCB		F 1.1						O 1.0	F 1.4				
	CPU PCB		F 1.5						O 1.4	F 1.4				
	Display PCB		F 1.8						O 1.8	F 1.8				
	Membrane Panel		D 3.0						O 2.2	D 2.0				
	Connector Panel		O 2.0							O 1.2		D 3.0		

Section II. MAINTENANCE ALLOCATION CHART FOR VENTILATOR

(1) GROUP NO.	(2) ASSEMBLY GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
	Manifold Assembly		O 0.8		O 0.6					O 1.2		D 3.4		
	External Power Jack		O 0.8						O 1.0					
02	Multivoltage Power Supply		O 0.3		O 0.1				O 0.2	O 1.0	O 1.6		01,02,03, 04,05	A, B
03	Patient Valve	O 0.2	O 1.0						O 0.2				01,02	
04	Case	O 0.2		O 0.4		O 0.3			O 0.4	O 0.6			01,02	A
05	Accessories	O 0.4		D 0.4					O 0.2				01,02	A

Section III. TOOLS AND TEST EQUIPMENT FOR VENTILATOR

(1) REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER
01	O,F,H,D	Tool Kit, Medical Equipment Maintenance and Repair: Repairmans	5180-00-611-7923
02	O,F,H,D	Tool Kit, Medical Equipment Maintenance and Repair: Organizational	5180-00-611-7924
03	F,H	Shop Equipment, Medical Maintenance: Depot (MEDSOM) Maintenance	4940-00-594-6455
04	O,F,H,D	Multimeter, AN/USM 486	6625-01-145-2430
		or	
		Multimeter, AN/PSM 45A	6625-01-265-6000
05	O,F,H,D	Tester, Current Leakage, TS 2514/P	6625-01-142-8233
06	O,F,H,D	Oscilloscope, AN/USM 488	6525-01-187-7847
		or	
		Oscilloscope, OS262 (P)/U	6625-01-007-9416
		w/Amplifier, Dual Trace, AM 6785/U	6625-00-361-5318
		w/Time Base, Dual Trace, TD1159/U	6625-00-261-5139
		or	
		Oscilloscope, OS291/G	6625-01-258-0022
07	O,F,H,D	Test Set, Circuit Component, TS 4138/P	6625-01-255-0839
08	O,F,H,D	Tester, Semiconductor, TS 1836 D/U	6625-00-138-7320
09	O,F,H,D	Generator, Signal, SG1171A/U	6625-01-216-9684
10	O,F,H,D	Counter, Electronic, Digital, AN/USM 459	6625-01-271-3012
11	O,F,H,D	Simulator, Medical Functions SM 874G	6625-01-298-3830

Section IV. REMARKS FOR VENTILATOR

(1) REFERENCE CODE	(2) REMARKS
A	Tools and test equipment are listed for each assembly group.
B	Perform an annual electrical safety inspection and test. Perform the inspection and test after repair or replacement of electrical/electronic components.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

C-1. Scope.

This appendix lists components of end item and basic issue items for the equipment to help you inventory items required for safe and efficient operation.

C-2. General.

The Components of End Item and Basic Issue Items lists are divided into the following sections.

a. *Section II. Components of End Item.* These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts.

b. *Section III. Basic Issue Items.* These are the minimum essential items required to place the equipment in operation, to operate it, and to perform emergency repairs. Basic issue items must be with the equipment during operation and whenever it is transferred between property accounts. This manual is your authority to request or requisition basic issue items, based on MTOE authorization of the end item.

C-3. Explanation of columns.

The following provides an explanation of columns found in both listings:

a. *Item Number, Column 1.* This column indicates the item number assigned to the item.

b. *National Stock Number, Column 2.* This column indicates the national stock number assigned to the item.

c. *Description, Column 3.* This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the commercial and government entity (CAGE) code in parentheses followed by the part number.

d. *Unit of Measure, Column 4.* This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation. These abbreviations are listed in the glossary.

e. *Quantity, Column 5.* This column indicates the quantity (QTY) of the item(s) provided with the equipment.

Section II. COMPONENTS OF END ITEM FOR VENTILATOR

(1) ITEM NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
1	6140-01-331-8528	Battery, Storage (63346) 021-0016-00	EA	1
2	6515-01-332-8779	Patient Valve (63346) 704-0750-04	EA	1
3		Hose, High Pressure (63346) 825-0002-00	EA	1
4	6515-01-332-8777	Hose, Spiral, 10-mm id (63346) 540-0076-00	EA	1
5	6515-01-332-8778	Hose, 1/8-in id (63346) 540-0073-00	EA	1
6	6515-01-332-8781	Hose, 3/16-in id (63346) 540-0075-00	EA	1

Section III. BASIC ISSUE ITEMS FOR VENTILATOR

(1) ITEM NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
1		Multivoltage Power Supply (63346) 704-0750-05	EA	1
2		Vehicle Power Assembly (63346) 708-0750-01	EA	1
3		Manual, Instruction (63346) 906-0750-02	EA	2
4		Airway, Guedal, Child's (63346) Not Available	EA	1
5		Airway, Guedal, Adult's (63346) Not Available	EA	1
6		Case (63346) 402-0005-00	EA	1
7		Holder, Hoses (63346) 334-0032-00	EA	5
8		Packing, Foam Insert (63346) 580-0750-01	EA	1
9		Mask, Adult/child (63346) 812-0004-00	EA	1
10	6515-01-332-8780	PEEP Valve (63346) 820-0048-00	EA	1

APPENDIX D

EXPENDABLE AND DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. Scope.

This appendix lists expendable and durable supplies and materials that are required to maintain the equipment. This listing is authorization to requisition and retain the items if not otherwise authorized.

D-2. Explanation of columns.

a. Item Number, Column 1. The item number (Item No.) is sequentially assigned.

b. Level, Column 2. This column identifies the lowest level of maintenance that requires the listed item. An explanation of the alphabetical character is provided in appendix B, section I of this manual.

c. National Stock Number, Column 3. This column indicates the national stock number assigned to the item.

d. Description, Column 4. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.

e. Unit of Measure, Column 5. This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by an alphabetical abbreviation. These abbreviations are listed in the glossary.

f. Quantity, Column 6. This column indicates the quantity (QTY) of the item(s) provided with the equipment.

Section II. EXPENDABLE AND DURABLE SUPPLIES AND MATERIALS LIST FOR VENTILATOR

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) UNIT OF MEASURE	(6) QTY
1	O	7920-01-004-7847	Cloth, Cleaning (97327) Rymple Cloth 301	RO	1
2	O	4940-01-087-3458	Workstation, ESD Control (12038) 4560901 or	EA	1
		4940-01-250-4236	Workstation, ESD Control (81349) MIL-W-87893-30 or	EA	1
		5920-01-253-5368	Workstation, ESD Control (12038) ASGK-MIL	EA	1
3	O	8030-00-889-3534	Tape, Antiseizing (81349) MIL-T-27730	RO	1
4	O	5970-00-419-4290	Tape, Insulation, Electrical (81349) MIL-I-24391	RO	1

APPENDIX E

REPAIR PARTS AND SPECIAL TOOLS LIST

Section I. INTRODUCTION

E-1. Scope.

This manual lists spare and repair parts, special tools, special test equipment; and other special support equipment required for the performance of unit level, direct support, general support, and depot level maintenance. It authorizes the requisitioning and issue of spare and repair parts in consonance with the MAC (app B).

E-2. General.

The Repair Parts and Special Tools List is divided into the following sections:

a. Repair Parts, Section II. A list of repair parts authorized for the performance of maintenance in figure number and item number sequence.

b. Special Tools, Test, and Support Equipment, Section III. A list of special tools, test, and support equipment authorized for the performance of maintenance.

E-3. Explanation of columns in section II.

a. Illustration, Column 1.

(1) *Figure Number*. This column indicates the figure number (FIG NO.) of the illustration on which the item is shown.

(2) *Item Number*. This column indicates the item number (ITEM NO.) used to identify each item on the illustration.

b. National Stock Number, Column 2. This column indicates the national stock number assigned to the item.

c. Description, Column 3. This column indicates the federal item name of the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.

d. Unit of Measure, Column 4. This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation.

e. Quantity, Column 5. This column indicates the quantity (QTY) of the item(s) to be used with or on the illustrated component, assembly, module, or end item.

E-4. Explanation of columns in section III.

a. Item Number, Column 1. This number is sequentially assigned.

b. Level, Column 2. This column identifies the lowest level of maintenance that requires the listed item. An explanation of the alphabetical character is provided in appendix B, section I of this manual.

c. National Stock Number, Column 3. This column indicates the national stock number assigned to the item.

d. Description, Column 4. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.

e. Unit of Measure, Column 5. This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation.

f. Quantity, Column 6. This column indicates the quantity (QTY) of the item(s) to be used with or on the equipment.

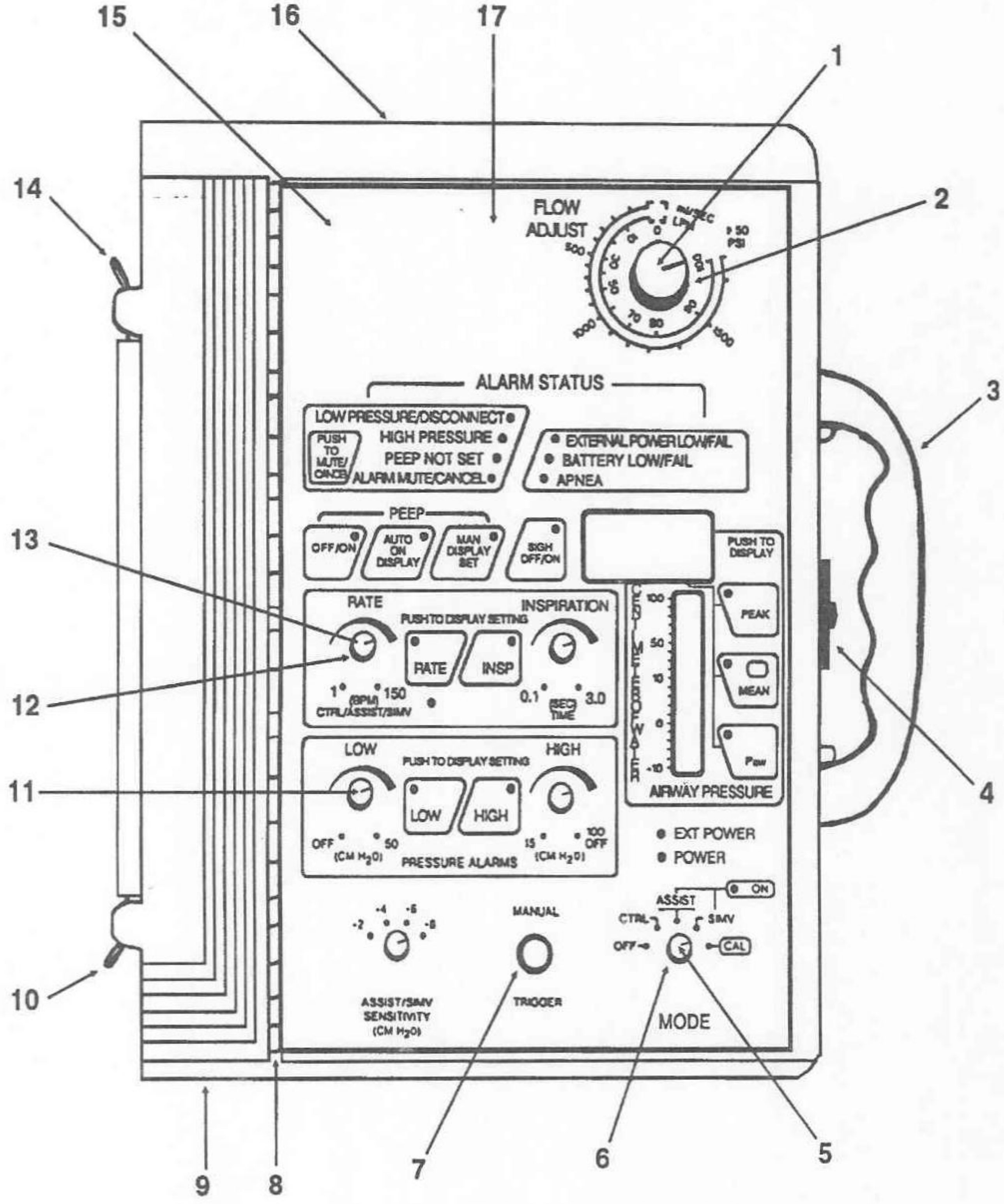

15
16
17
1
2
14
3
13
12
11
4
10
9
8
7
6
5
FLOW ADJUST
ALARM STATUS
LOW PRESSURE/DISCONNECT
PUSH TO MUTE/CANCEL
HIGH PRESSURE
PEEP NOT SET
ALARM MUTE/CANCEL
EXTERNAL POWER LOW/FAIL
BATTERY LOW/FAIL
APNEA
PEEP
OFF/ON
AUTO ON DISPLAY
MAN DISPLAY SET
SIGH OFF/ON
PUSH TO DISPLAY
RATE
INSPIRATION
PUSH TO DISPLAY SETTING
RATE
INSP
1 (BPM) 150
CTRL/ASSIST/SIMV
0.1 (SEC) 3.0
TIME
PEAK
MEAN
Paw
CENTIMETERS OF WATER
AIRWAY PRESSURE
LOW
HIGH
PUSH TO DISPLAY SETTING
LOW
HIGH
OFF 50
(CM H2O)
15 100 OFF
(CM H2O)
PRESSURE ALARMS
EXT POWER
POWER
ASSIST
ON
CTRL
SIMV
OFF
CAL
MODE
MANUAL
TRIGGER
ASSIST/SIMV SENSITIVITY (CM H2O)
-2 -4 -6 -8

Figure E-1. Control module components.

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-1	1		Cap, Collet Knob, Gray (63346) 392-0033-00	EA	1
E-1	2	5355-01-331-8507	Knob, Collet, 1/4 in Shaft, Black (63346) 392-0032-00	EA	1
E-1	3		Handle (63346) 390-0002-00	EA	1
E-1	4		Latch, Locking (63346) 0007-00	EA	1
E-1	5		Cap, Collet Knob, Black (63346) 392-0026-00	EA	2
E-1	6	5355-01-331-8508	Knob, Collet, 1/8 in Shaft, Gray (63346) 392-0025-00	EA	4
E-1	7		Guard, Push-button Switch, Black (63346) 133-0001-00	EA	1
E-1	8		Hinge (63346) 394-0006-00	EA	1
E-1	9		Door, Battery Compartment (63346) 418-0750-11	EA	1
E-1	10		Latch, Slide, Right (63346) 394-0009-00	EA	1
E-1	11		Cap, Collet Knob, Red (63346) 392-0028-00	EA	2
E-1	12		Cap, Collet Knob, Gray (63346) 392-0027-00	EA	2
E-1	13	5355-01-331-8509	Knob, Collet, 1/8 in Shaft, Black (63346) 392-0024-00	EA	2
E-1	14		Latch, Slide, Left (63346) 394-0008-00	EA	1
E-1	15		Panel, Membrane (63346) 130-0001-00	EA	1
E-1	16		Cover, Top (63346) 416-0750-11	EA	1
E-1	17		Door, Top, Battery Compartment (63346) 418-0750-21	EA	1
E-1	*	5815-00-448-1817	Nut, Keps, 4-40 (57712) 86724	EA	10

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-1	*		Nut, Hex, Chrome, 9⁄16 by 18 (63346) 346-9618-00	EA	2
E-1	*		Pin, Stop, Knob (63346) 348-0002-00	EA	1
E-1	*		Screw, Slotted, Binding Head, 4-40 by 1⁄4 in (63346) 352-0440-04	EA	3
E-1	*		Spacer, Hex, Threaded, 4-40 by 5⁄8 in (63346) 368-0010-00	EA	6
E-1	*		Spacer, Nylon, No. 4 id by 0.25 in od by 0.25 in (63346) 368-0011-00	EA	4
E-1	*		Spacer, Nylon, No. 4 id by .025 in od by 7⁄16 in (63346) 368-0018-00	EA	4
E-1	*		Washer, Flat, No. 4 (63346) 376-0008-00	EA	6
E-1	*		Nut, Cover, Collet Knob, Black (63346) 392-0029-00	EA	2
E-1	*		Nut, Cover, Collet Knob, Gray (63346) 392-0030-00	EA	2
E-1	*		Nut, Cover, Collet Knob, Red (63346) 392-0031-00	EA	2
E-1	*		Tape, Foam, 8-1⁄2 in by 1 in by 1⁄4 in (63346) 312-0043-00	EA	1
E-1	*		Holder, Battery Pack (63346) 334-0033-00	EA	1
E-1	*	3640-00-284-0133	Screw, Phillips, Binding Head, 4-40 by 3⁄8 in (63346) 8111	EA	2
E-1	*		Screw, Phillips, Flat Head, 6-32 by 1⁄2 in (63346) 357-0632-08	EA	4
E-1	*		Assembly, Case, Upper (63346) 703-0750-05	EA	1

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-1	*		Assembly, Case, Lower (63346) 703-0750-06	EA	1
E-1	*		Assembly, Battery Pack (63346) 704-0750-03	EA	1
E-1	*		Screw, Slotted, Binding Head, 4-40 by 1/4 in (63346) 352-0440-04	EA	9
E-1	*		Spacer, Hex, 4-40 by 5/8 in (63346) 368-0009-00	EA	6
E-1	*		Spacer, Hex, Threaded, 4-40 by 1/4 in (63346) 368-0014-00	EA	4
E-1	*		Washer, Flat, No. 6 (63346) 376-0007-00	EA	6
E-1	*		Washer, Lock, Internal Tooth, No. 4 (63346) 376-0019-00	EA	3
E-1	*		Washer, Fiber, No. 4 (63346) 376-0035-00	EA	4
E-1	*		Bracket, Battery Compartment Divider (63346) 404-0750-41	EA	1
E-1	*		Tube, 1/8 in id by 1/4 in od by 8 in (63346) 540-0083-00	EA	1
E-1	*		Label, "Condensed Operating Instructions and Tidal Volume Computation Chart" (63346) 325-0750-1	EA	1
E-1	*		Label, ID, Military (63346) 325-0750-03	EA	1
E-1	*		Rivet, Pop, No. 4 (63346) 338-0005-00	EA	4
E-1	*		Nut, Cap, Hex, 3-48 (63346) 346-0348-06	EA	2
E-1	*		Nut, Keps, 10-32 (63346) 346-1032-01	EA	2

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-1	*		Screw, Slotted, Binding Head, 6-32 by ¼ in (63346) 352-0632-10	EA	2
E-1	*		Screw, Phillips, Binding Head, 10-32 by ⅝ in (63346) 356-1032-10	EA	2
E-1	*		Spring, Latch (63346) 370-0004-00	EA	2
E-1	*		Washer, Flat, No. 10 (63346) 376-0003-00	EA	2
E-1	*		Washer, Flat, Aluminum, ⅛ in id (63346) 376-0031-00	EA	4
E-1	*		Bracket, Mounting (63346) 404-0750-51	EA	1
E-1	*		Bracket, Support Handle (63346) 404-0750-81	EA	1
E-1	*		Cover, Bottom (63346) 416-0750-31	EA	1
E-1	*	5340-01-331-8538	Bumper, Nonmetallic (63346) 450-0008-00	EA	4
E-1	*		Tubing, Shrink, 3⁄16 in id by 1 in (63346) 016-0004-00	EA	3
E-1	*		Tubing, Shrink, ½ in id by 1-½ in (63346) 016-0025-00	EA	1
E-1	*		Ferrite (63346) 031-0002-00	EA	1
E-1	*		Connector, 5-pin, Power (63346) 089-0011-00	EA	1
E-1	*		Terminal, Crimp (63346) 092-0006-00	EA	5
E-1	*		Plug, 2-conductor (63346) 099-0010-02	EA	1
E-1	*		Connector, 5-pin (63346) 100-0002-00	EA	1
E-1	*	5975-01-121-0745	Cable Tie, Miniature (63346) 305-0001-00	EA	3

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-1	*		Jumper, Black, 1-½ in (63346) 700-0750-02	EA	1
E-1	*		Jumper, Black, 6-½ in (63346) 700-0750-03	EA	1
E-1	*		Jumper, Black, 7-½ in (63346) 700-0750-04	EA	1
E-1	*		Jumper, Brown, 9 in (63346) 700-0750-05	EA	1
E-1	*		Jumper, Red, 9 in (63346) 700-0750-07	EA	1
E-1	*		Jumper, Violet, 9 in (63346) 700-0750-09	EA	1

* Indicates parts that are not shown in the illustration.

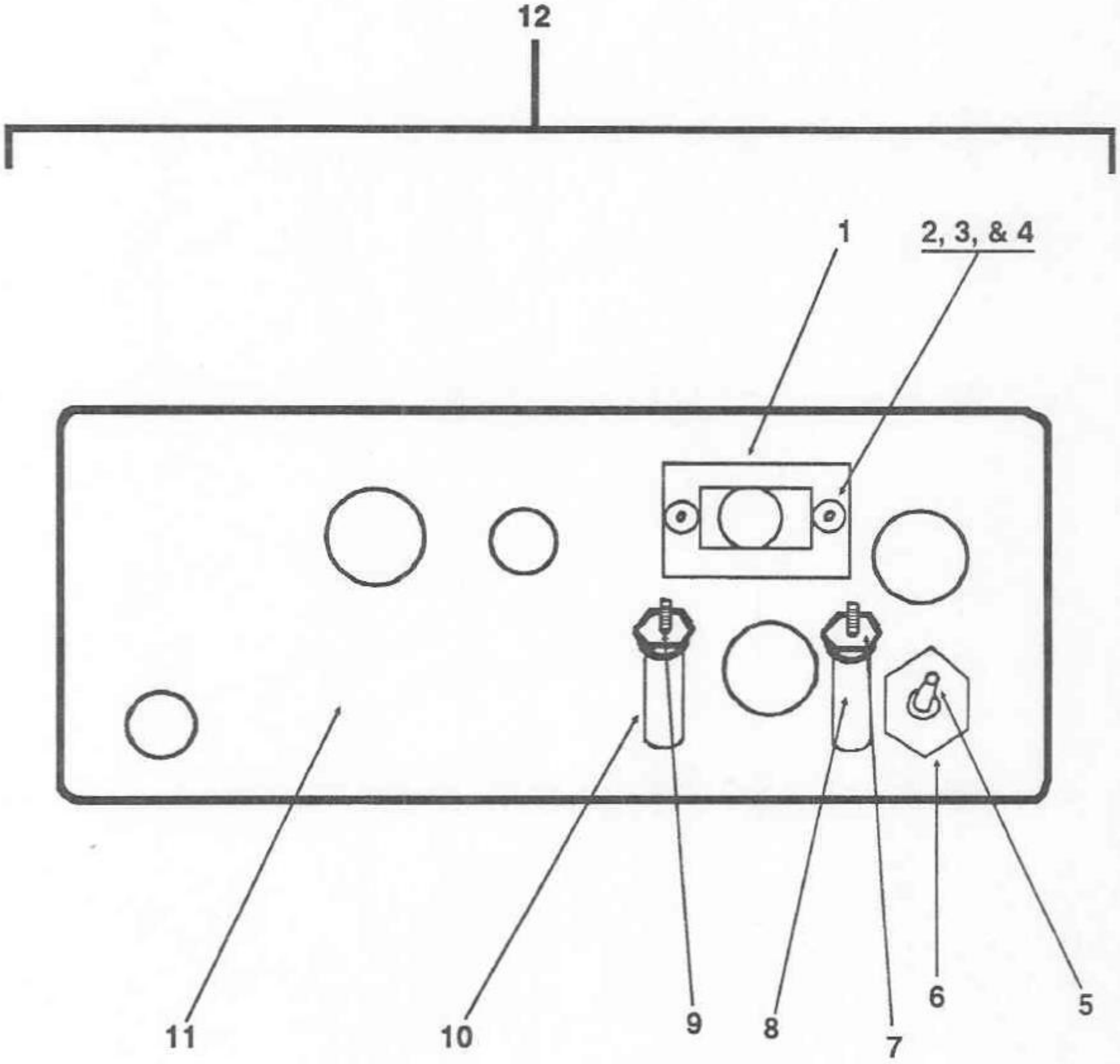
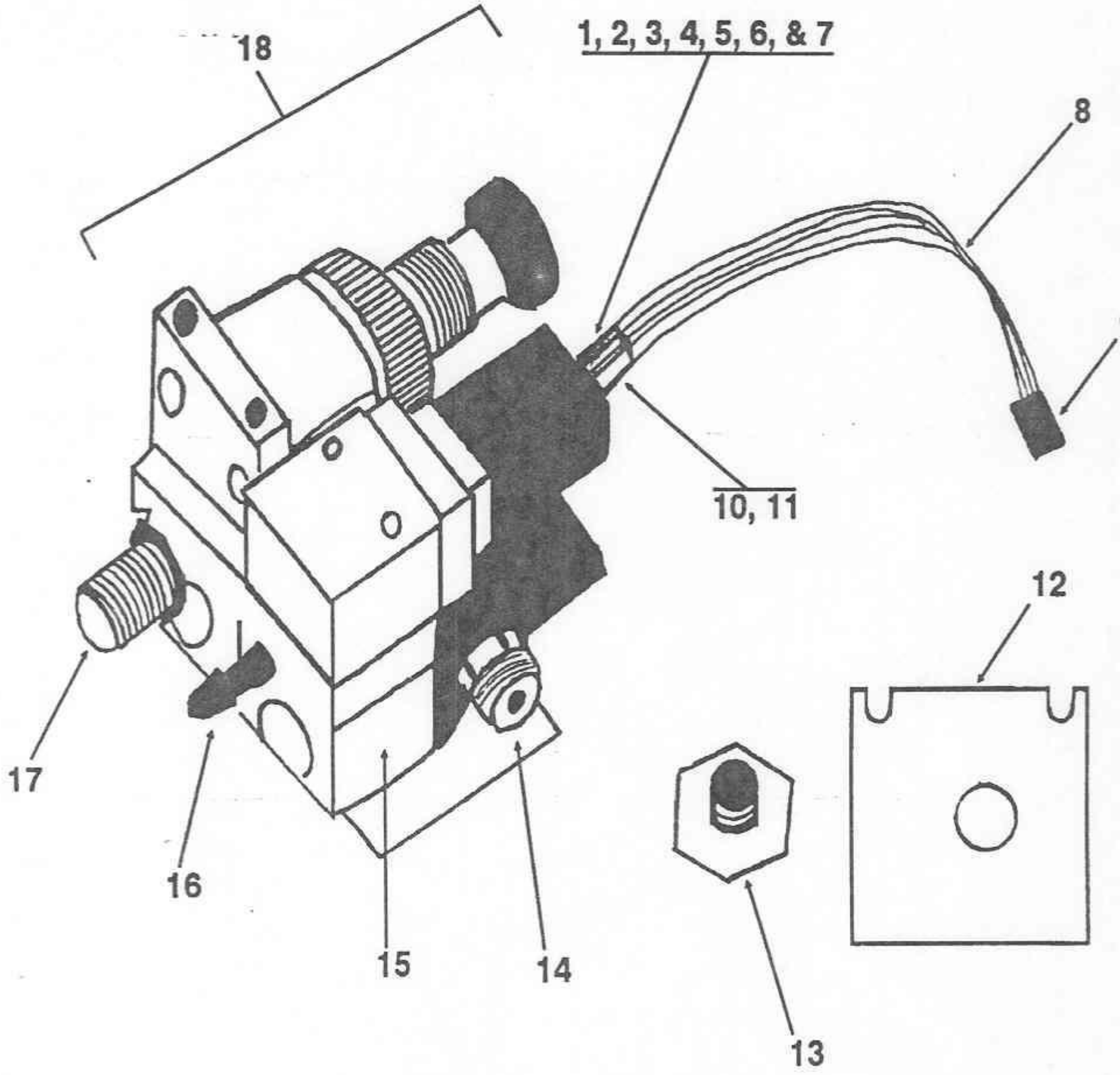

12
1
2, 3, & 4
11
10
9
8
7
6
5

Figure E-2. Connector panel components.

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-2	1		Bracket, External Power Jack (63346) 404-0750-21	EA	2
E-2	2	5815-00-448-1817	Nut, Keps, 4-40 (57712) 86764	EA	2
E-2	3		Washer, Flat, No. 4 (63346) 376-0008-00	EA	4
E-2	4		Screw, Phillips, Pan Head, 4-40 by 3⁄8 in (63346) 358-0440-06	EA	2
E-2	5		Nut, Hex, Nylon, 1⁄4 - 20 (63346) 346-1420-05	EA	1
E-2	6		Hose Connector (for 1⁄8 in id Hose) (63346) 0138-00	EA	1
E-2	7		Nut, Hex, 2-56 (63346) 346-0256-00	EA	2
E-2	8		Washer, Lock, Split, No. 2 (63346) 376-0040-00	EA	2
E-2	9		Screw, Phillips, Pan Head, 2-56 by 1 in (63346) 358-0256-16	EA	2
E-2	10		Spacer, Nylon, No. 2 id by 0.187 in od by 9⁄16 in (63346) 368-0012-00	EA	2
E-2	11		Panel (63346) 422-0750-11	EA	1
E-2	12		Assembly, Connector, Panel (63346) 703-0750-03	EA	1
E-2	*		Cap, Hole Plug, 0.312 in dia (63346) 416-0018-00	EA	1

* Indicates a part that is not shown in the illustration.


18
1, 2, 3, 4, 5, 6, & 7
8
9
10, 11
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17
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13

Figure E-3. Air/oxygen components.

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-3	1		Jumper, Black, 2-½ in (63346) 700-0750-01	EA	1
E-3	2		Jumper, Red, 2-½ in (63346) 700-0750-06	EA	1
E-3	3		Jumper, Black, 7 in (63346) 700-0750-15	EA	1
E-3	4		Jumper, Gray, 7 in (63346) 700-0750-16	EA	1
E-3	5		Jumper, Yellow, 7 in (63346) 700-0750-17	EA	1
E-3	6		Jumper, White, 7 in (63346) 700-0750-18	EA	1
E-3	7		Jumper, Green, 7 in (63346) 700-0750-19	EA	1
E-3	8		Cable, Ribbon, 16-conductor, 9 in Long (63346) 010-0016-00	EA	1
E-3	9		Socket, Connector, 16-pin (63346) 100-0001-00	EA	1
E-3	10		Tubing, Shrink, ½ in id by 1-½ in (63346) 016-0025-00	EA	1
E-3	11		Tubing, Shrink, 3⁄16 in id by 1 in (63346) 016-0004-00	EA	1
E-3	12		Bracket, Lock (63346) 404-0750-71	EA	1
E-3	13		Valve, Nut (63346) 490-0016-00	EA	1
E-3	14		Nipple, Hex, Chrome, ⅛ in npt to 9⁄16-18 by 0.912 in (63346) 480-0141-00	EA	1
E-3	15	8305-01-257-8812	Tape, Teflon (04963) Scotch 5490	EA	1
E-3	16		Barb, Hose, 3⁄16 in id (63346) 480-0144-00	EA	1

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-3	17		Nipple, Hex, Chrome, 1/8 in npt to 9/16-18 by 1.187 in (63346) 480-0142-00	EA	1
E-3	18		Assembly, Valve, Flow Control (63346) 704-0750-01	EA	1
E-3	*	6350-01-331-8527	Alarm, Audible (Buzzer) (63346) 027-0009-00	EA	1
E-3	*		Manifold, Solenoid/Regulator w/Bracket (63346) 033-0005-00	EA	1
E-3	*		Jack, 3-conductor (63346) 089-0016-00	EA	1

* Indicates parts that are not shown in the illustration.

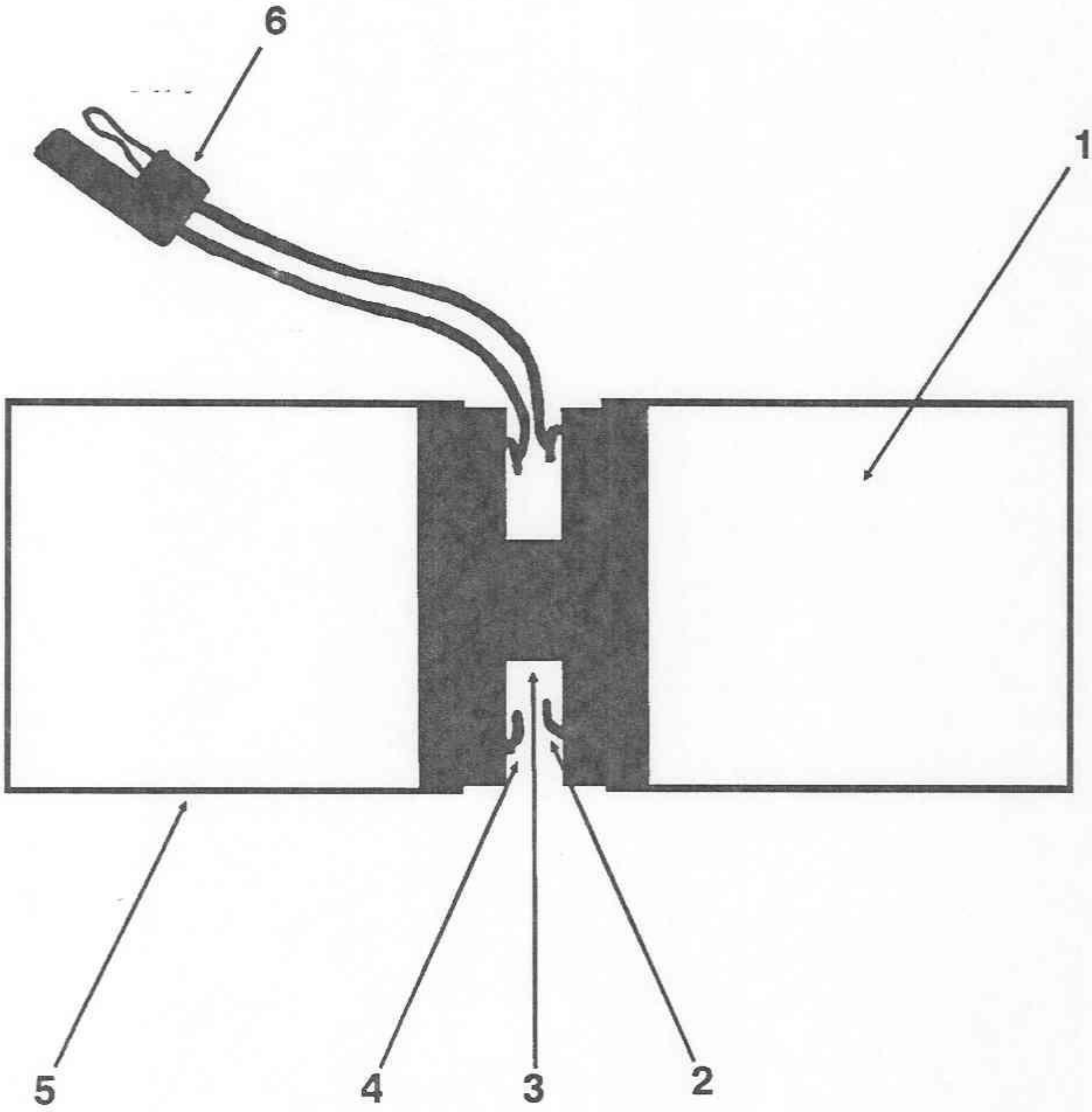

Figure E-4. Battery pack components.

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-4	1	6140-01-331-8528	Battery, Storage (63346) 021-0016-00	EA	2
E-4	2		Jumper, No. 18 AWG, Orange, 3 in (63346) 700-0750-11	EA	1
E-4	3		Insulator, Battery (63346) 310-0016-00	EA	1
E-4	4		Glue, Hot Melt (63346) 600-0003-00	TU	AR
E-4	5		Tubing, Shrink (63346) 016-0029-00	EA	1
E-4	6		Plug, 2-connector, Automotive (63346) 099-0009-02	EA	1

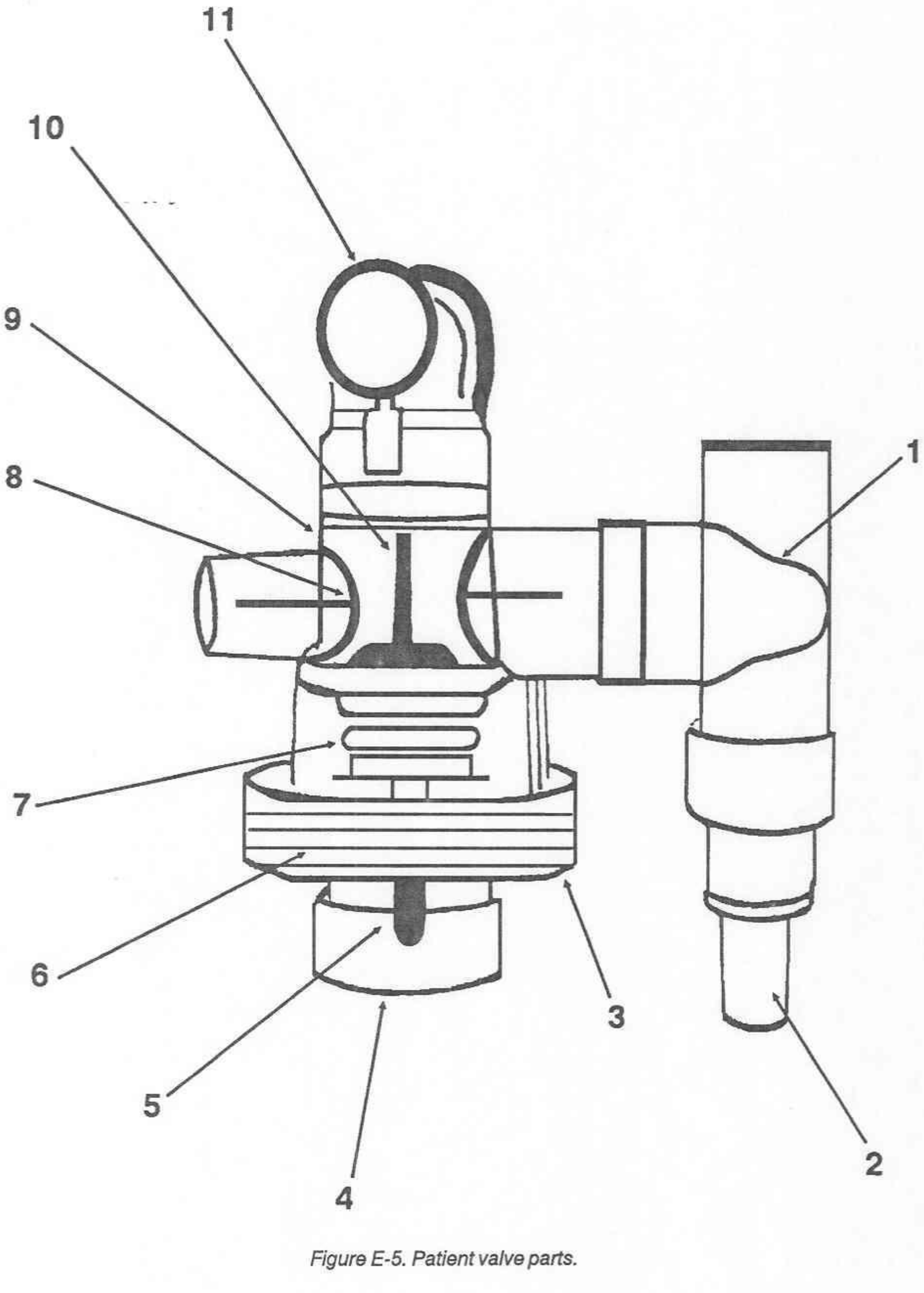
11
10
9
8
1
7
6
3
5
2
4

Figure E-5. Patient valve parts.

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG -- NO.	- ITEM NO.				
E-5	1		Elbow, Gas Inlet (63346) 490-0025-00	EA	1
E-5	2		Reducer, 15 mm Male to 10 mm Male (63346) 490-0027-11	EA	1
E-5	3		Exhalation Cap, Inner (63346) 490-0022-00	EA	1
E-5	4		Exhalation Cap, Outer (63346) 490-0021-00	EA	1
E-5	5		Valve, Leaf (63346) 490-0014-00	EA	1
E-5	6		Collar, Threaded (63346) 490-0023-00	EA	1
E-5	7		Valve, Diaphragm (63346) 490-0006-00	EA	1
E-5	8		Valve, Leaf (63346) 490-0005-00	EA	2
E-5	9		Housing, Patient Valve (63346) 490-0020-00	EA	1
E-5	10		Baffle (63346) 490-0024-00	EA	1
E-5	11		Elbow, Patient Connection (63346) 490-0026-00	EA	1

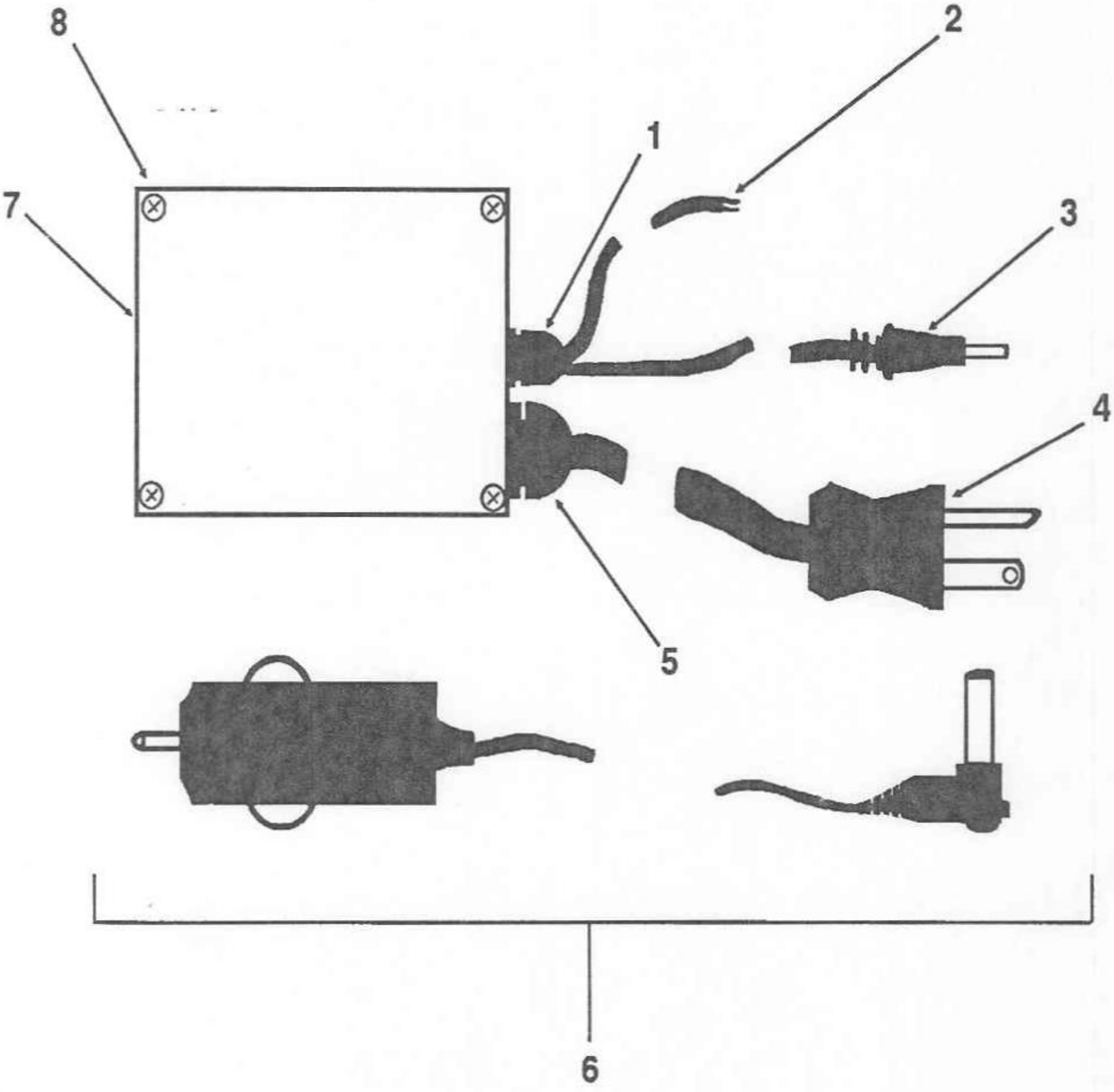

Figure E-6. Multivoltage power supply and vehicle power cable assembly.

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-6	1		Bushing, Strain Relief (63346) 340-0030-00	EA	1
E-6	2		Cable, 18 AWG, 2-conductor, 75 in (63346) 002-0001-00	EA	1
E-6	3		Cable, DC Power Plug, Shielded 18 AWG, 6 ft (63346) 708-0750-01	EA	1
E-6	4	6515-01-312-5808	Line Cord (63346) 708-0004-00	EA	1
E-6	5		Bushing, Strain Relief (63346) 340-0031-00	EA	1
E-6	6		Vehicle Power Cable Assembly (63346) 708-0750-01	EA	1
E-6	7		Case, Multivoltage Power Supply (63346) 402-0750-02	EA	1
E-6	8		Screw, Phillips, Flat Head, 4-40 by 5/8 in (63346) 357-0440-10	EA	5
E-6	*		Tubing, Shrink, 3/16 in id by 1 in (63346) 016-0004-00	EA	4
E-6	*	5920-01-312-0825	Fuse, Cartridge, 1 amp (63346) 081-0010-00	EA	1
E-6	*		Terminal, Crimp (63346) 092-0007-00	EA	7
E-6	*		Connector, 7-pin (63346) 100-0005-00	EA	1
E-6	*	5930-01-331-8510	Switch, Rotary, Voltage Selection (63346) 117-0013-00	EA	1
E-6	*		Tape, Foam, 1/2 in by 1 in by 1/8 in (63346) 312-0019-00	EA	2
E-6	*		Label, Manufacturer Data (63346) 325-0750-04	EA	1
E-6	*	5920-01-331-8504	Fuseholder (63346) 334-0034-00	EA	1
E-6	*		Nut, Keps, 4-40 (63346) 346-0440-01	EA	5

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-6	*		Spacer, Nylon, No. 4 id by 0.25 in od by 0.25 in (63346) 368-0011-00	EA	4
E-6	*		Terminal, Ring, 14-16 AWG (63346) 374-0017-00	EA	1
E-6	*		Bracket, Transformer Mounting (63346) 404-0001-00	EA	1
E-6	*		Silicone (63346) 606-0001-00	TU	AR
E-6	*		Jumper, Black, 6 in (63346) 700-0750-10	EA	1
E-6	*		Jumper, Red, 6 in (63346) 700-0750-12	EA	1
E-6	*	5999-01-331-8522	PCB, Analog/Power Supply (63346) 702-0750-07	EA	1
E-6	*	5999-01-331-8524	PCB, Multivoltage Power Supply (63346) 702-0750-05	EA	1
E-6	*		Transformer, Power (63346) 023-0016-00	EA	1
E-6	*		Diode, Bridge Rectifier (63346) 047-0331-00	EA	2
E-6	*		Regulator, 12 VDC Output (63346) 055-7812-00	EA	1
E-6	*		Header (Connector), 7-pin (63346) 093-0019-07	EA	1
E-6	*	5910-01-295-3209	Capacitor, Fixed Electrolytic (63346) 252-4786-31	EA	1
E-6	*	5910-01-312-0824	Capacitor, Fixed Electrolytic (63346) 257-1044-12	EA	4
E-6	*		Cable Tie, 5-½ in (63346) 305-0002-00	EA	1

* Indicates parts that are not shown in the illustration.

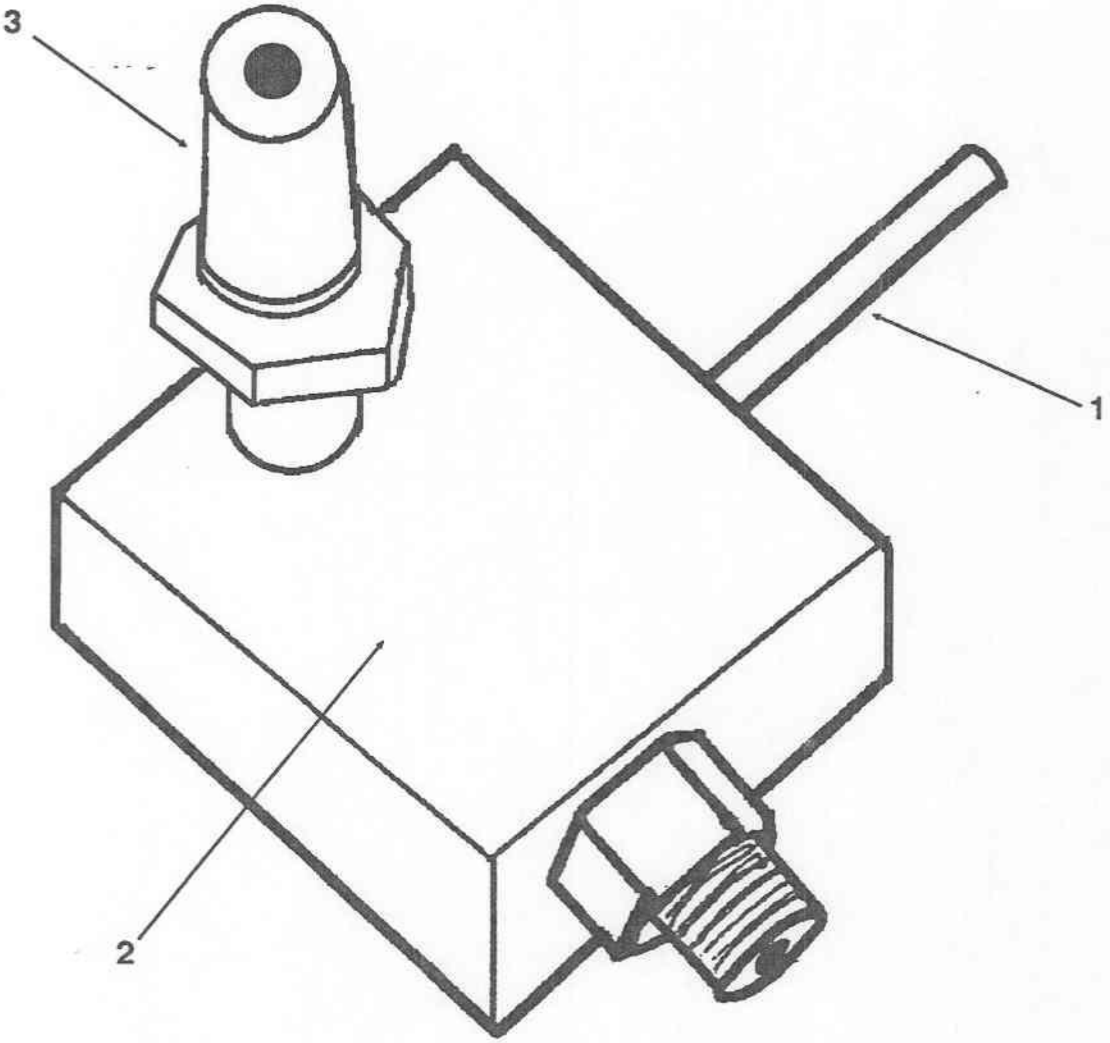

Figure E-7. Flow control valve assembly.

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-7	1		Valve, Spindle (63346) 490-0015-11	EA	1
E-7	2		Body, Valve (63346) 490-0019-11	EA	1
E-7	3		Nipple, Hex, Chrome, 1⁄8 in npt to 10 mm by 2.075 in (63346) 704-0750-06	EA	1
E-7	*		Washer, Nylon, Shoulder, No. 10 by 3⁄16 in (63346) 376-0036-00	EA	1
E-7	*		Washer, Nylon, Flat, 0.281 in id by 0.5 in od by 0.03 in (63346) 376-0037-00	EA	1
E-7	*		Valve, Swivel (63346) 490-0018-11	EA	1
E-7	*		Tube, Latex, 1⁄4 in id by 7⁄16 in od by 0.8 in (63346) 540-0082-00	EA	1

*Indicates parts that are not shown in the illustration.

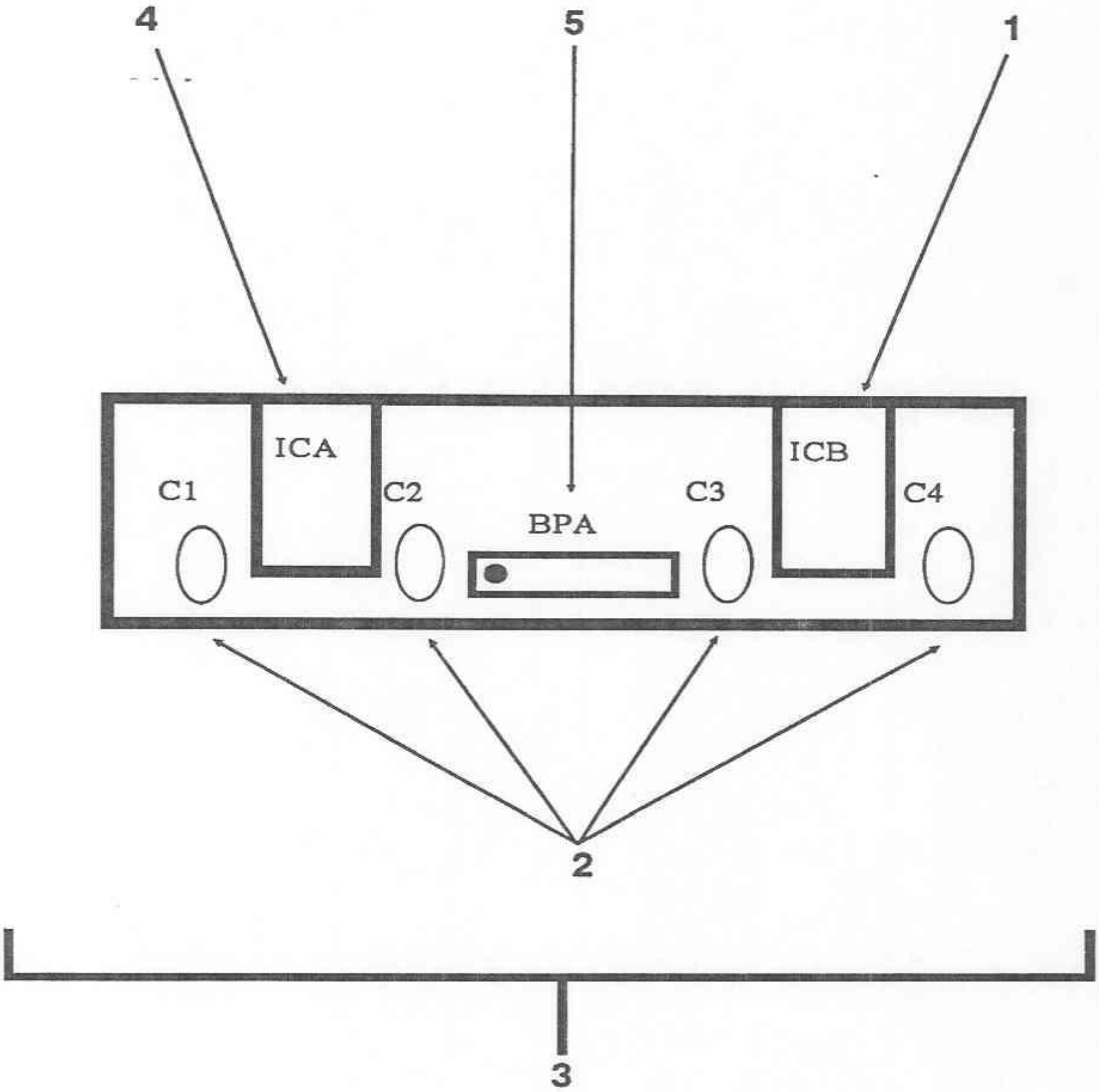
4
5
1
ICA
ICB
C1
C2
C3
C4
BPA
2
3

Figure E-8. Linear regulators PCB parts.

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION FIG NO.	(1) ILLUSTRATION ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
E-8	1		Regulator, 8 VDC (63346) 055-7808-00	EA	1
E-8	2		Capacitor, 0.1µF (63346) 257-1044-12	EA	4
E-8	3	5999-01-331-8525	PCB, Linear Regulators (63346) 702-0750-06	EA	1
E-8	4		Regulator, 5 VDC (63346) 055-7805-00	EA	1
E-8	5		Connector, 5-pin, Male (63346) 093-0021-05	EA	1
E-8	*		Nut, Keps, 4-40 (63346) 346-0440-01	EA	4
E-8	*		Screw, Slotted, Binding Head, 4-40 by 3⁄8 in (63346) 352-0440-06	EA	4
E-8	*		Bracket, Linear Regulators (63346) 404-0750-61	EA	1

*Indicates parts that are not shown in the illustration.

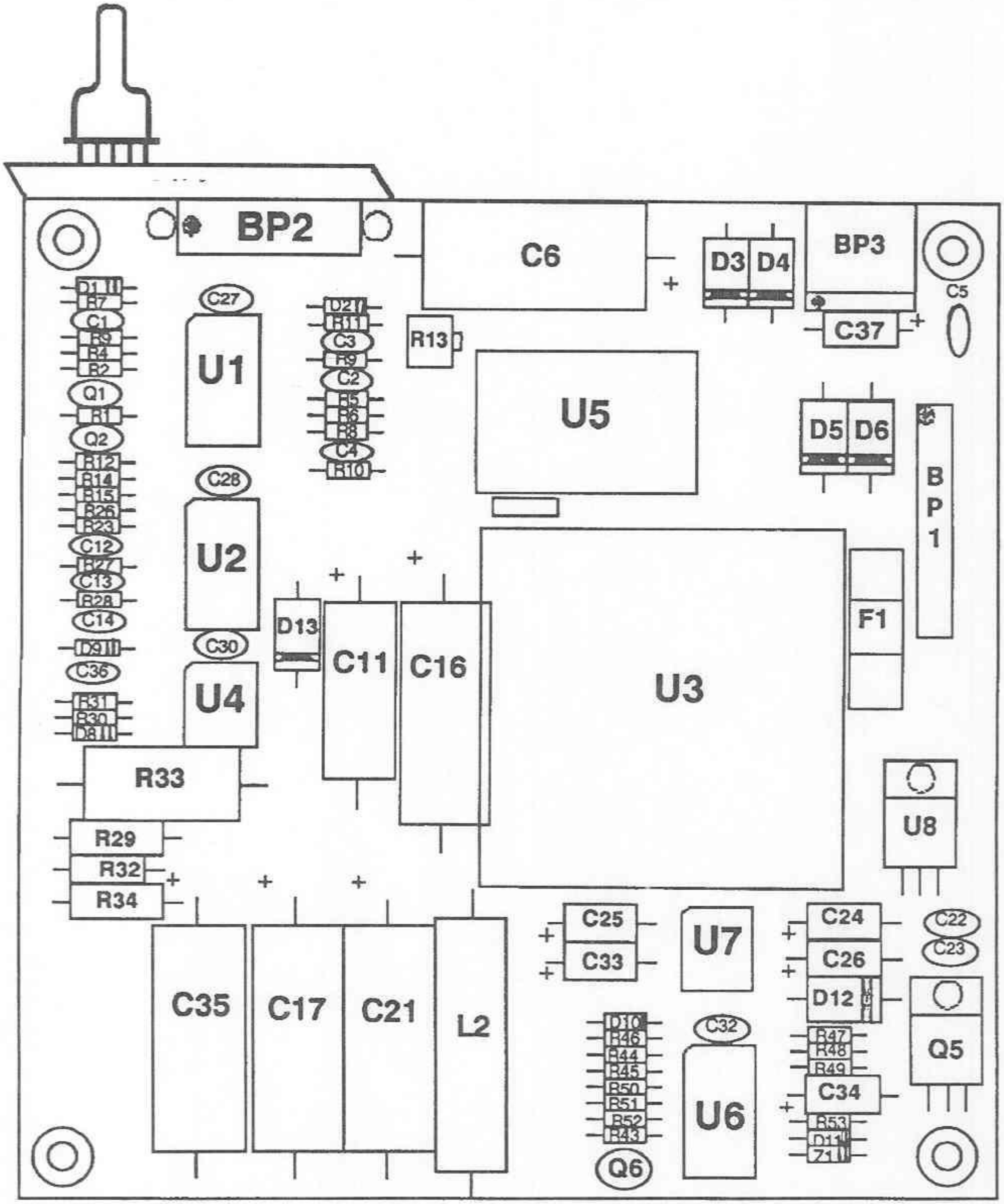
BP2
C6
+
D3
D4
BP3
C5
C37
+
D1
R7
C1
R3
R4
R2
Q1
R1
Q2
R12
R14
R15
R26
R23
C12
R27
C13
R28
C14
D9
C36
R31
R30
D8
C27
U1
C28
U2
C30
U4
D2
R11
C3
R9
C2
R5
R6
R8
C4
R10
R13
U5
D5
D6
B
P
1
+
+
D13
C11
C16
F1
U3
U8
R33
R29
R32
R34
+
+
+
C35
C17
C21
L2
C25
C33
+
+
U7
C24
C26
+
+
C22
C23
D12
Q5
D10
R46
R44
R45
R50
R51
R52
R43
Q6
C32
U6
R47
R48
R49
C34
+
R53
D11
Z1

Figure E-9. Analog/power supply PCB components.

Section II. REPAIR PARTS LIST
FOR
VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-9	1	5999-01-331-8522	PCB, Analog/Power Supply (63346) 702-0750-07	EA	1
E-9	2		Inductor, 560 µH (63346) 029-0002-00	EA	1
E-9	3		Diode, 1N914 (63346) 047-0914-00	EA	3
E-9	4		Diode, 1N4001 (63346) 047-4001-00	EA	2
E-9	5		Diode, 1N5819 (63346) 047-5819-00	EA	1
E-9	6		Diode, 1N5822 (63346) 047-5822-00	EA	2
E-9	7		Diode, Zener, 1N4733A, 5.1 VDC (63346) 049-4733-10	EA	1
E-9	8		Transistor, D45H2, PNP (63346) 051-0452-00	EA	1
E-9	9		Transistor, IRF9531A, P-Channel (63346) 051-9531-10	EA	1
E-9	10		IC, TLC274ACN, Quad Op-amplifier (63346) 055-0274-00	EA	1
E-9	11		IC, LM324N, Quad Op-amplifier (63346) 055-0324-00	EA	1
E-9	12		IC, LM336, Voltage Reference, 2.5 VDC (63346) 055-0336-00	EA	1
E-9	13		IC, LM339N, Quad Voltage Comparator (63346) 055-0339-00	EA	1
E-9	14		IC, LM385, Voltage Reference, 1.2 VDC (63346) 055-0385-12	EA	2
E-9	15		IC, LM3578, Switching Regulator (63346) 055-3578-00	EA	1
E-9	16		IC, ICL7660, Voltage Converter (63346) 055-7660-00	EA	1
E-9	17		IC, 7806T, 6 VDC Voltage Regulator (63346) 055-7806-00	EA	1
E-9	18		Fuse, 1 amp (63346) 081-0009-00	EA	1

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-9	19		Header (Connector), Right Angle, Friction Lock, 5-pin (63346) 093-0013-05	EA	1
E-9	20		Header (Connector), Straight, Dual Row, Male, 13 pins by 2 rows (63346) 093-0014-26	EA	1
E-9	21		Header (Connector), Right Angle, Single Row, Male, 10-pin (63346) 093-0015-10	EA	1
E-9	22		Header (Connector), Straight, Single Row, Female, 5-pin (63346) 093-0023-05	EA	1
E-9	23		Socket, IC, DIP, 14-pin (63346) 109-0001-00	EA	3
E-9	24		Socket, IC, DIP, 8-pin (63346) 109-0005-00	EA	2
E-9	25		Resistor, Carbon Film, ¼ W, 5%, 10 Ω (63346) 200-0100-02	EA	1
E-9	26		Resistor, Carbon Film, ¼ W, 5%, 110 Ω (63346) 200-0111-02	EA	1
E-9	27		Resistor, Carbon Film, ¼ W, 5%, 1.5 MΩ (63346) 200-0155-02	EA	2
E-9	28		Resistor, Carbon Film, ¼ W, 5%, 2 KΩ (63346) 200-0202-02	EA	1
E-9	29		Resistor, Carbon Film, ¼ W, 5%, 220 KΩ (63346) 200-0224-02	EA	1
E-9	30		Resistor, Carbon Film, ¼ W, 5%, 4.3 KΩ (63346) 200-0432-02	EA	1
E-9	31		Resistor, Carbon Film, ¼ W, 5%, 470 Ω (63346) 200-0471-02	EA	1
E-9	32		Resistor, Carbon Film, ¼ W, 5%, 5.1 KΩ (63346) 200-0512-02	EA	1
E-9	33		Resistor, Carbon Film, ¼ W, 5%, 51 KΩ (63346) 200-0513-02	EA	1
E-9	34		Resistor, Carbon Film, ¼ W, 5%, 10 MΩ (63346) 201-0106-02	EA	2

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-9	35		Resistor, Carbon Film, ½ W, 5%, 750 Ω (63346) 202-0751-02	EA	1
E-9	36		Resistor, Metal Oxide Film, 1 W, 5%, 1 Ω (63346) 204-0010-02	EA	1
E-9	37		Resistor, Metal Oxide Film, 1 W, 5%, 0.51 Ω (63346) 204-051X-02	EA	1
E-9	38		Resistor, Wirewound, 5 W, 5%, 2 Ω (63346) 210-0020-00	EA	1
E-9	39		Resistor, Metal Film, ¼ W, 1%, 10 KΩ (63346) 213-1002-00	EA	4
E-9	40		Resistor, Metal Film, ¼ W, 1%, 100 KΩ (63346) 213-1003-00	EA	4
E-9	41		Resistor, Metal Film, ¼ W, 1%, 110 KΩ (63346) 213-1103-00	EA	2
E-9	42		Resistor, Metal Film, ¼ W, 1%, 121 KΩ (63346) 213-1213-00	EA	1
E-9	43		Resistor, Metal Film, ¼ W, 1%, 1.24 KΩ (63346) 213-1241-00	EA	1
E-9	44		Resistor, Metal Film, ¼ W, 1%, 133 KΩ (63346) 213-1333-00	EA	1
E-9	45		Resistor, Metal Film, ¼ W, 1%, 24.3 KΩ (63346) 213-2432-00	EA	1
E-9	46		Resistor, Metal Film, ¼ W, 1%, 39.2 KΩ (63346) 213-3922-00	EA	1
E-9	47		Resistor, Metal Film, ¼ W, 1%, 4.12 KΩ (63346) 213-4121-00	EA	1
E-9	48		Resistor, Metal Film, ¼ W, 1%, 422 KΩ (63346) 213-4223-00	EA	2
E-9	49		Resistor, Metal Film, ¼ W, 1%, 7.5 KΩ (63346) 213-7501-00	EA	1
E-9	50		Resistor, Metal Film, ¼ W, 1%, 9.09 KΩ (63346) 213-9091-00	EA	2
E-9	51		Resistor, Variable, Vertical Mounting, 10 KΩ (63346) 216-0103-00	EA	1

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION FIG NO.	(1) ILLUSTRATION ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
E-9	52		Transducer (63346) 240-0750-04	EA	1
E-9	53		Capacitor, Aluminum, Electrolytic, 1 μF, 63 VDC (63346) 252-1056-61	EA	2
E-9	54		Capacitor, Aluminum, Electrolytic, 10 μF, 25 VDC (63346) 252-1066-31	EA	1
E-9	55		Capacitor, Aluminum, Electrolytic 47 μF, 10 VDC (63346) 252-4766-11	EA	2
E-9	56		Capacitor, Aluminum, Electrolytic 470 μF, 10 VDC (63346) 252-4776-11	EA	1
E-9	57		Capacitor, Aluminum, Electrolytic 470 μF, 16 VDC (63346) 252-4776-21	EA	1
E-9	58		Capacitor, Aluminum, Electrolytic 470 μF 25 VDC (63346) 252-4776-31	EA	4
E-9	59		Capacitor, Aluminum, Electrolytic 470 μF, 50 VDC (63346) 252-4776-51	EA	1
E-9	60		Capacitor, Polyester, 0.001 μF, 100 VDC (63346) 258-1024-12	EA	2
E-9	61		Capacitor, Polyester, 0.0018 μF, 100 VDC (63346) 258-1824-12	EA	1
E-9	62		Capacitor, Polyester, 0.018 μF, 100 VDC (63346) 258-1834-12	EA	2
E-9	63		Capacitor, Polyester, 0.0022 μF, 100 VDC (63346) 258-2224-12	EA	1
E-9	64		Capacitor, Metallized Film, 0.1 μF, 50 VDC (63346) 259-1044-51	EA	9
E-9	65		Capacitor, Metallized Film, 1 μF, 50 VDC (63346) 259-1054-51	EA	1

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-9	66		Capacitor, Ceramic Disc, 22 pF, 100 VDC (63346) 266-2203-12	EA	1
E-9	67		Heat Sink (63346) 310-0013-00	EA	3
E-9	68		Fuseholder (63346) 334-0052-00	EA	2
E-9	69		Nut, Keps, 4-40 (63346) 346-0440-01	EA	2
E-9	70		Nut, Hex, Nylon, 4-40 (63346) 346-0440-05	EA	2
E-9	71		Screw, Phillips, Pan Head, 4-40 by 3/8 in (63346) 352-0440-06	EA	4
E-9	72		Jumper, Yellow, 2 in (63346) 700-0750-13	EA	1
E-9	73		Transducer, Pressure (63346) 804-0001-00	EA	11

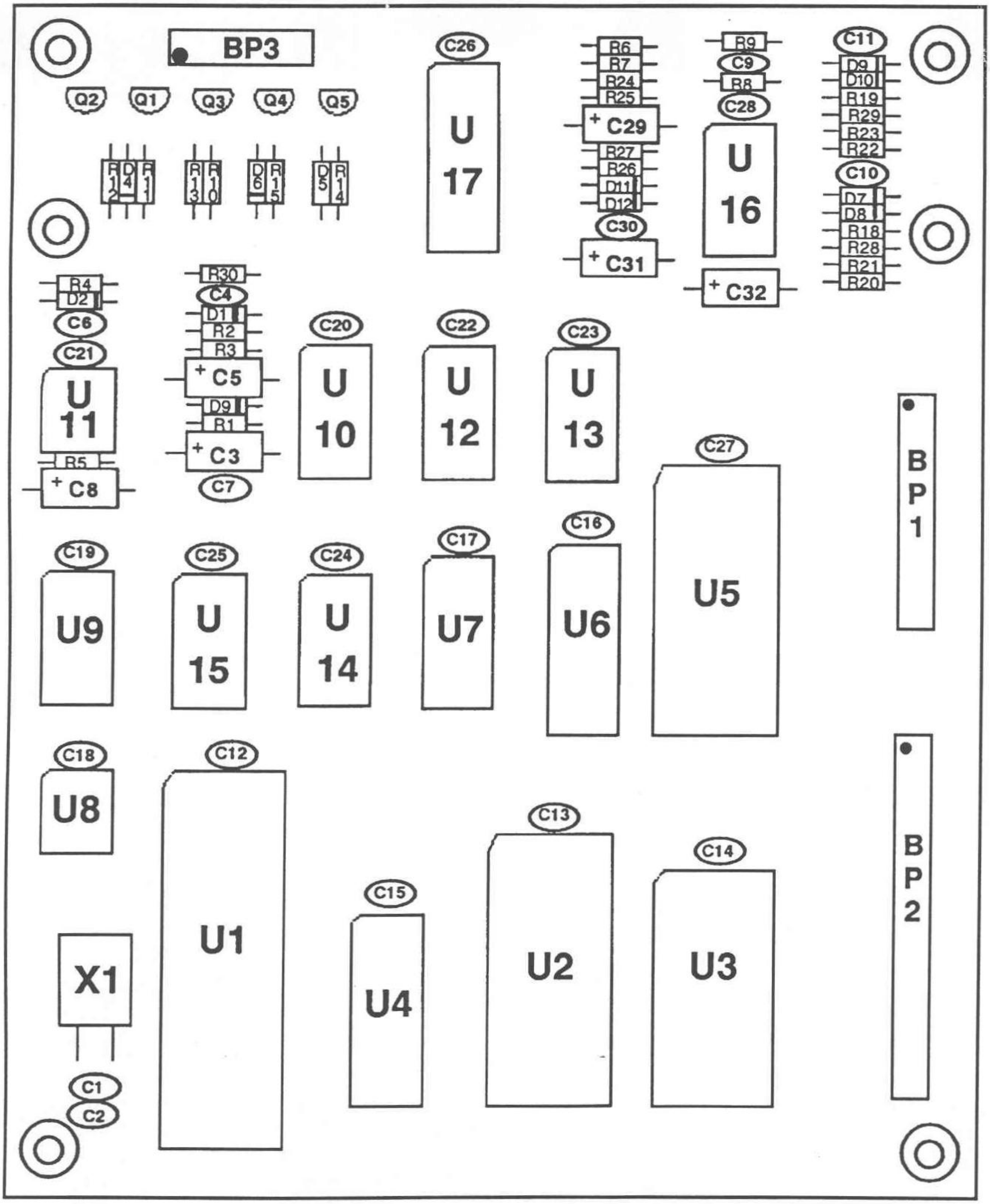
BP3
Q2
Q1
Q3
Q4
Q5
R12
D4
R11
R13
R10
D6
R15
D5
R14
C26
U17
R6
R7
R24
R25
C29
R27
R26
D11
D12
C30
C31
R9
C9
R8
C28
U16
C32
C11
D9
D10
R19
R29
R23
R22
C10
D7
D8
R18
R28
R21
R20
R4
D2
C6
C21
U11
R5
C8
R30
C4
D1
R2
R3
C5
D9
R1
C3
C7
C20
U10
C22
U12
C23
U13
C27
U5
BP1
C19
U9
C25
U15
C24
U14
C17
U7
C16
U6
C18
U8
C12
U1
C15
U4
C13
U2
C14
U3
BP2
X1
C1
C2

Figure E-10. CPU PCB components.

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-10	1	5999-01-331-8523	CPU PCB (63346) 702-0750-02	EA	1
E-10	2		Diode, 1N914 (63346) 047-0914-00	EA	8
E-10	3		Diode, 1N4001 (63346) 047-4001-00	EA	4
E-10	4		Transistor, 2N2222 (63346) 051-2222-00	EA	5
E-10	5		IC, 74LS04 (63346) 053-7404-00	EA	1
E-10	6		IC, 74LS08 (63346) 053-7408-00	EA	1
E-10	7		IC, 74LS138 (63346) 053-7413-80	EA	1
E-10	8		IC, 74LS244 (63346) 053-7424-40	EA	1
E-10	9		IC, 74LS32 (63346) 053-7432-00	EA	1
E-10	10		IC, 74LS373 (63346) 053-7437-30	EA	2
E-10	11		IC, 74LS74 (63346) 053-7474-00	EA	1
E-10	12		IC, CD4047 (63346) 054-4047-00	EA	1
E-10	13		IC, CD4584 (63346) 054-4584-00	EA	1
E-10	14		IC, LM324N (63346) 055-0324-00	EA	1
E-10	15	5999-01-289-5301	Assembly, Circuit Card (63346) 055-0555-00	EA	1
E-10	16		IC, ADC8089CNN (63346) 055-0809-00	EA	1
E-10	17		IC, 27C256-25 (63346) 055-2725-60	EA	1
E-10	18		IC, 6116N-20 (63346) 055-6116-20	EA	1

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-10	19		IC, 8031 (63346) 055-8031-00	EA	1
E-10	20		IC, NMC9346 (63346) 055-9346-00	EA	1
E-10	21		Crystal, 6 MHz (63346) 079-0001-00	EA	1
E-10	22		Header (Connector), Straight, Dual Row, Female, 20 pins by 2 rows (63346) 093-0010-40	EA	1
E-10	23		Header (Connector), Straight, Dual Row, Male, 8 pins by 2 rows (63346) 093-0012-16	EA	1
E-10	24		Header (Connector), Straight, Dual Row, Male, 13 pins by 2 rows (63346) 093-0016-26	EA	1
E-10	25		Socket, DIP, 14-pin (63346) 109-0001-00	EA	7
E-10	26		Socket, DIP, 16-pin (63346) 109-0002-00	EA	1
E-10	27		Socket, DIP, 28-pin (63346) 109-0003-00	EA	2
E-10	28		Socket, DIP, 8-pin (63346) 109-0005-00	EA	2
E-10	29		Socket, DIP, 20-pin (63346) 109-0011-00	EA	3
E-10	30		Socket, DIP, 24-pin (63346) 109-0012-00	EA	1
E-10	31		Socket, DIP, 40-pin (63346) 109-0013-00	EA	1
E-10	32		Resistor, Carbon Film, 1/4 W, 5%, 10 Ω (63346) 200-0100-02	EA	3
E-10	33		Resistor, Carbon Film, 1/4 W, 5%, 100 Ω (63346) 201-0101-02	EA	1
E-10	34		Resistor, Carbon Film, 1/4 W, 5%, 10 KΩ (63346) 200-0103-02	EA	5

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-10	35		Resistor, Carbon Film, 1⁄4 W, 5%, 100 KΩ (63346) 200-0104-02	EA	1
E-10	36		Resistor, Carbon Film, 1⁄4 W, 5%, 1.2 MΩ (63346) 200-0125-02	EA	1
E-10	37		Resistor, Carbon Film, 1⁄4 W, 5%, 1.5 KΩ (63346) 200-0152-02	EA	2
E-10	38		Resistor, Carbon Film, 1⁄4 W, 5%, 220 Ω (63346) 200-0221-02	EA	1
E-10	39		Resistor, Carbon Film, 1⁄4 W, 5%, 3 KΩ (63346) 200-0302-02	EA	3
E-10	40		Resistor, Carbon Film, 1⁄4 W, 5%, 390 KΩ (63346) 200-0394-02	EA	1
E-10	41		Resistor, Carbon Film, 1⁄4 W, 5%, 56 KΩ (63346) 200-0563-02	EA	3
E-10	42		Resistor, Carbon Film, 1⁄4 W, 5%, 6.8 KΩ (63346) 200-0682-02	EA	1
E-10	43		Resistor, Metal Film, 1⁄4 W, 1%, 200 KΩ (63346) 213-2003-00	EA	3
E-10	44		Resistor, Metal Film, 1⁄4 W, 1%, 78.7 KΩ (63346) 213-7872-00	EA	3

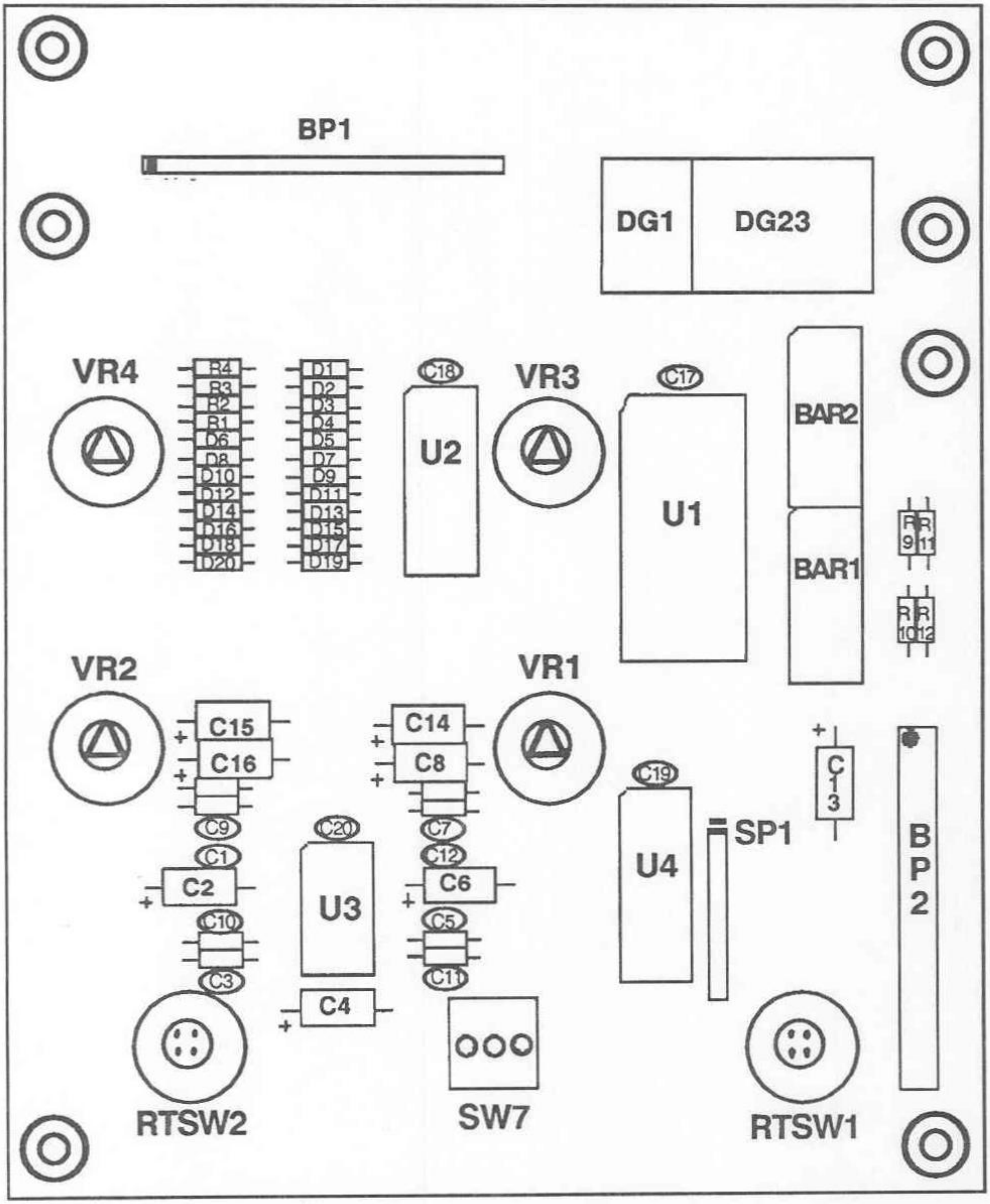
BP1
DG1
DG23
VR4
R4
R3
R2
R1
D6
D8
D10
D12
D14
D16
D18
D20
D1
D2
D3
D4
D5
D7
D9
D11
D13
D15
D17
D19
C18
U2
VR3
C17
U1
BAR2
BAR1
R9
R11
R10
R12
VR2
C15
C16
C14
C8
VR1
C9
C1
C2
C10
C3
C20
U3
C7
C12
C6
C5
C11
C19
U4
SP1
C13
BP2
C4
SW7
RTSW2
RTSW1

Figure E-11. Display PCB components.

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-11	1	5999-01-331-8526	Display PCB (63346) 702-0750-01	EA	1
E-11	2		Diode, 1N914 (63346) 047-0914-00	EA	24
E-11	3		IC, 74LS240 (63346) 053-7424-00	EA	1
E-11	4		IC, 74LS244 (63346) 053-7424-40	EA	1
E-11	5		IC, LM324N (63346) 055-0324-00	EA	1
E-11	6		IC, ICM7218AIJI (63346) 055-7218-00	EA	1
E-11	7	5980-01-331-8515	LED (63346) 067-0516-00	EA	1
E-11	8	5980-01-331-8514	LED (63346) 067-0526-00	EA	1
E-11	9	5980-01-331-8516	LED (63346) 067-2421-00	EA	2
E-11	10		Header(Connector), Right Angle, Single Row, Female, 20-pin (63346) 093-0005-20	EA	1
E-11	11		Header (Connector), Straight, Dual Row, Male, 20 pins by 2 rows (63346) 093-0008-40	EA	1
E-11	12		Socket, IC, DIP, 14-pin (63346) 109-0001-00	EA	1
E-11	13		Socket, IC, DIP, 28-pin (63346) 109-0003-00	EA	1
E-11	14		Socket, IC, DIP, 20-pin (63346) 109-0011-00	EA	4
E-11	15		Socket, Strip, SIP, 20-pin (63346) 109-0014-00	EA	2
E-11	16	5930-01-331-8511	Switch, Rotary (63346) 117-0014-00	EA	1
E-11	17	5930-01-332-1270	Switch, Rotary (63346) 117-0015-00	EA	1

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-11	18	5930-01-331-8512	Switch, Push-button, SPDT, NO, w/Button (63346) 121-0006-00	EA	1
E-11	19		Resistor, Carbon Film, 1/4 W, 5%, 10Ω (63346) 200-0100-02	EA	4
E-11	20		Resistor, Carbon Film, 1/4 W, 5%, 10 KΩ (63346) 200-0103-02	EA	4
E-11	21		Resistor, Carbon Film, 1/4 W, 5%, 240 Ω (63346) 200-0241-02	EA	4
E-11	22		Resistor, Network, SIP, 1/8 W, 2%, 10 KΩ (63346) 208-0103-01	EA	1
E-11	23		Resistor, Variable, 1/2 W, 10 KΩ (63346) 214-0103-01	EA	4
E-11	24		Capacitor, Aluminum, Electrolytic, 47 μF, 10 VDC (63346) 252-4766-11	EA	8
E-11	25		Capacitor, Metallized Film, 0.1 μF, 50 VDC (63346) 259-1044-51	EA	12

Section II. REPAIR PARTS LIST FOR VENTILATOR

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
N/A	1		Assembly, Final Electromechanical (63346) 701-0750-02	EA	1
N/A	2		Assembly, Transducer (63346) 702-0750-04	EA	1
N/A	3		Assembly, Membrane Panel (63346) 703-0750-01	EA	1
N/A	4		Assembly, Bracket, Linear Regulators (63346) 703-0750-07	EA	1
N/A	5		Assembly, Battery Pack (63346) 704-0750-03	EA	1
N/A	6	6515-01-332-8779	Valve, Patient (63346) 704-0750-04	EA	1
N/A	7		Assembly, Flow Control Valve (63346) 704-0750-06	EA	1
N/A	8		Assembly, Harness (63346) 704-0750-10	EA	1
N/A	9		Shield, Aluminum, EMI (63346) 703-0750-05	EA	1
N/A	10		Tape, Foam, 3 in by 1 in by 1 in (63346) 312-0041-00	EA	2

Section III. SPECIAL TOOLS, TEST, AND SUPPORT EQUIPMENT FOR VENTILATOR

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) UNIT OF MEASURE	(6) QTY
1	O	6515-01-130-1379	Oxygen Monitor (22270) 04026	EA	1
2	O		Test Lung (49315) 4-000612-00	EA	1

APPENDIX F

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

F-1. Scope.

This appendix lists additional items that are authorized for support of the ventilator.

F-2. General.

This list identifies items that should accompany the ventilator and that should be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

F-3. Explanation of columns.

The following provides an explanation of columns found in the list:

a. *Item Number, Column 1*. This column indicates the item number assigned to the item.

b. *National Stock Number, Column 2*. This column indicates the national stock number assigned to the item.

c. *Description, Column 3*. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the commercial and government entity (CAGE) code in parentheses followed by the part number.

d. *Unit of Measure, Column 4*. This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation. These abbreviations are listed in the glossary.

e. *Quantity, Column 5*. This column indicates the quantity (QTY) of the item(s) for optional use.

Section II. ADDITIONAL AUTHORIZATION LIST FOR VENTILATOR

(1) ITEM NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
1	6530-01-319-4044	Air/oxygen Blender (63346) 800-0751-01	EA	1
2		Manifold (Not Available)	EA	1
3	6680-00-962-6844	Regulator, Oxygen (13408) 0112	EA	1
4	8110-00-550-8484	Yoke Adapter, Oxygen (44503) 7800	EA	1
5		Swivel Nut, DISS (63346) 480-0147-00	EA	1
6		Nipple, Male, DISS (63346) 480-0146-00	EA	1
7		Adapter, Elbow (63346) 480-0145-00	EA	1

GLOSSARY

A	Ampere.
AC	Alternating current.
ADC	Analog to digital converter.
AFR	Air Force regulation.
AMP (amp)	Ampere.
ANSI	American National Standards Institute.
app	Appendix.
AR	Army regulation.
AR	As required. (Used in the quantity column in appendix E.)
ASSIST	A ventilator operating mode that allows a patient initiated breath to be synchronized with the current ventilator control settings.
AUX	Auxiliary.
AWG	American wire gauge.
BPM	Breaths per minute.
C	Continuously illuminated (indicators).
C	Operator or crew.
CAGE	Commercial and government entity.
CAL	Calibration.
chap	Chapter.
cm	Centimeter.
CPAP	Continuous positive airway pressure.
CPU	Central processing unit.
CTA	Common table of allowances.
CTRL	Control (mode of ventilator operation).
D	Depot level maintenance.
DA	Department of the Army.
db	Decibel.
DC	Direct current.
°C	Degrees Celsius.
°F	Degrees Fahrenheit.
dia	Diameter.
DIP	Dual in-line package.
DISS	Diameter indexed safety system.
DLA	Defense Logistics Agency.
DLAM	Defense Logistics Agency manual.
DPSC	Defense Personnel Support Center.

DS	Direct support.
EA	Each.
EEPROM	Electrically erasable programmable read-only memory.
EMI	Electromagnetic interference.
EPROM	Erasable programmable read-only memory.
ESD	Electrostatic discharge.
EXT	External.
µF	Microfarad (one-millionth).
F	Direct support maintenance.
FAL	Fail.
fig	Figure.
FIO_2	Fractional concentration of inspired oxygen.
FM	Field manual.
FSC	Federal supply class.
FSCM	Federal supply code for manufacturers. This is an obsolete term. CAGE (commercial and government entity) is the correct acronym.
ft	Foot (feet).
GS	General support.
µH	Microhenry.
H	General support maintenance.
H_2O	Chemical symbol for water.
Header (connector)	A mounting plate through which the insulated terminals or leads are brought out from a hermetically sealed transistor, IC, or other device.
hrs	Hours.
Hz	Hertz.
IC	Integrated circuit.
id	Inner diameter.
ID	Identification.
I:E	Inspiratory time/expiratory time ratio.
in	Inch.
INSP	Inspiration.
ISO	International Standards Organization.
JTA	Joint table of allowances.
KΩ	Kilohm.
kg	Kilogram.
lbs	Pounds.
LED	Light emitting diode.
LPM (lpm)	Liters per minute.

M	Momentarily illuminated (indicators).
MΩ	Megohm.
MAC	Maintenance allocation chart.
MAN	Manual.
MEDSOM	Medical supply, optical, and maintenance (battalion).
MHz	Megahertz (1 million).
min	Minute.
mL	Milliliter.
mL/sec	Milliliters per second.
mm	Millimeter.
MPL	Mandatory parts list.
MTOE	Modified table of organization and equipment.
NO. (No.)	Number.
NO	Normally open (switch).
npt	National pipe thread.
NSN	National Stock Number.
O	Unit maintenance.
O_2	Oxygen.
od	Outer diameter.
ohm (Ω)	Measurement of electrical resistance.
para	Paragraph.
P_{aw}	Airway pressure.
PCB	Printed circuit board.
PEEP	Positive end expiratory pressure.
pF	Picofarad (one-trillionth).
PMCS	Preventive maintenance checks and services.
PNP	Positive-negative-positive (transistor).
psi	Pounds per square inch.
PVC	Polyvinylchoride.
QA	Quality assurance.
QC	Quality control.
QTY	Quantity.
RAM	Random access memory.
RO	Roll.
RPL	Repair parts list.
SB	Supply bulletin.
sec	Second.
sec	Section.

SER	Serial (number).
SIGH	A deep and prolonged audible inspiration and expiration of air; especially when involuntary and expressing some emotion or feeling such as grief, yearning, weariness, or relief.
SIMV	Synchronized intermittent mandatory ventilation.
SIP	Single in-line package.
SPDT	Single pole, double throw (switch).
TB	Technical bulletin.
TDA	Table of distribution and allowances.
TM	Technical manual.
TU	Tube.
USP	United States Pharmacopia.
VAC	Volts alternating current.
VDC	Volts direct current.
W	Watts.

INDEX

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Frederick, MD 21702

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TM 8-6530-009-24&P	6 Feb 88	Ventilator, Volume, Portable Models 750 and 750M

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-6	2-5			Change electrical cable to electrical assembly. REASON: Corrects nomenclature.
E-11		E-6		Reverse call-out numbers 4 and 8. REASON: Correctly identifies part.

SAMPLE

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DSN 343-XXXX

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To be distributed in accordance with DA Form 12-34-E, block 4454, Unit, Direct Support, and General Support Maintenance requirements for TM 8-6530-009-24&P.

METRIC SYSTEM CONVERSIONS

CHANGE	TO	MULTIPLY	CHANGE	TO	MULTIPLY
inches	centimeters	2.540	centimeters	inches	.394
feet	meters	.305	meters	feet	3.280
yards	meters	.914	meters	yards	1.094
sq inches	sq centimeters	6.451	sq centimeters	sq inches	.155
sq feet	sq meters	.093	sq meters	sq feet	10.764
cubic feet	cubic meters	.028	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	milliliters	fluid ounces	.034
pints	liters	.473	liters	pints	2.113
quarts	liters	.946	liters	quarts	1.057
gallons	liters	3.785	liters	gallons	.264
ounces	grams	28.349	grams	ounces	.035
pounds	kilograms	.454	kilograms	pounds	2.205

TEMPERATURE CONVERSION

Degrees Fahrenheit to Degrees Celsius: (°F - 32) X .5555 = °C

Degrees Celsius to Degrees Fahrenheit: (°C X 1.8) + 32 = °F

WEIGHTS

1 gram = 10 decigrams = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds

LINEAR MEASURE

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches

CUBIC MEASURE

1 cu centimeter = 1000 cu millimeters = .06 cu inch
1 cu decimeter = 1000 cu centimeters = 61.02 cu inches
1 cu meter = 1000 cu decimeters = 35.31 cu feet

LIQUID MEASURE

1 centiliter = 10 milliters = .34 fluid ounce
1 deciliter = 10 centiliters = 3.38 fluid ounces
1 liter = 10 deciliters = 33.81 fluid ounces